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Geological Survey of Queensland.
PUBLICATION NO 198.

GOLD, PLATINUM, TINSTONE, AND MONAZITE

IN

THE BEACH SANDS ON THE SOUTH COAST,

QUEENSLAND.

With Appendixes on the Beach Sands of New South Wales; and on the Physical Properties, Sources, and Uses of Platinum.

(WITH 2 PLATES AND 3 FIGURES.)

By LIONEL C. BALL, B.E.,
ASSISTANT GOVERNMENT GEOLOGIST.

BRISBANE:
BY AUTHORITY: GEORGE ARTHUR VAUGHAN, GOVERNMENT PRINTER, WILLIAM STREET.

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GOLD, PLATINUM, TINSTONE, AND MONAZITE IN THE BEACH SANDS ON THE SOUTH COAST OF QUEENSLAND.*

INTRODUCTION.

In May last a sample of brown concentrates from the auriferous sands of the South Coast was delivered at the Geological Survey Office for examination as to the presence of platinum.

A number of minute flattened grains of a white lustrous metal were obtained by carefully panning off the accompanying minerals. These grains were dissolved in *aqua regia*; the solution was evaporated to dryness, and the salt remaining was then dissolved in water. The addition of potassium iodide caused the formation of a deep rose colouration, proving the presence of platinum.

The concentrates consist chiefly of well-rounded grains, though a few prismatic crystals are also to be seen. The grains are red-brown and honey yellow (tinstone and monazite), white (zircon, topaz, and quartz), black (magnetite and ilmenite), and greenish (tourmaline).

The presence of phosphates (monazite) was proved by heating the powdered material with a drop of sulphuric acid, and to the dried residue adding ammonium molybdate with excess of nitric acid, when, on evaporation the yellow colour of ammonium phospho-molybdate was obtained.

The Government Analyst found the same sample to contain 4.3 per cent. of the cerium group of earths (calculated as oxides, and including 0.4 per cent. thoria) together with phosphoric acid.

On heating the powdered concentrates mixed with soda carbonate and potassium cyanide on charcoal before the blowpipe, a bead of metallic tin was obtained, proving the presence of cassiterite.

Mr. Rands in his report on the Albert and Logan district,† published in 1889, refers to the layers of black sand containing gold, on the beach between the mouth of Nerang Creek and Tweed Heads, but no mention is made of platinum, tinstone, or monazite. Mr. Rands was of opinion that the gold came from the siliceous rocks up the creeks. He further says that at the mouth of Currumbin Creek several layers from one to six inches thick had been worked, one at a depth of 16 feet yielding four ounces of gold in a week, but water in the sands was giving a good deal of trouble.

---

* With Appendices on the Beach Sands of New South Wales, and the Physical Properties, Sources, and Uses of Platinum, with two Plates and three Figures.

† No. 51 of the G.S.Q. Publications.

In the following pages it is shown that at intervals along the Currumbin-Coolangatta Beach the sands contain payable tin, accompanied by gold. The concentrates, however, assay very much lower than was expected, and the assays show that the work thus far done for tin has been at a loss—either owing to local poverty of the ground or to escape of tinstone with the tailings. Nevertheless the hope is entertained that the ground may yet be proved sufficiently rich for dredging.

LOCALITY AND TOPOGRAPHY.

The ground likely to be auriferous lies between the mouth of Currumbin Creek and Point Danger, a total extent of five miles.

On the north-west of the area, within one and a-half miles of Currumbin Creek, are several outcrops of schists and slates forming low hills and ridges—the extremity of Macpherson's Range. At the south-east, for a little over a mile from Point Danger, there are areas of clay-slate capped in great part by dolerite. The intervening lowlands consist of sand dunes and swamps, there being not a single rock outcropping along the beach for a distance of three miles.

The southern boundary of this ground is determined by Cobaki Creek (in New South Wales), the average width of the ground being one and a-half miles; only one-half of it, however, is in the State of Queensland.

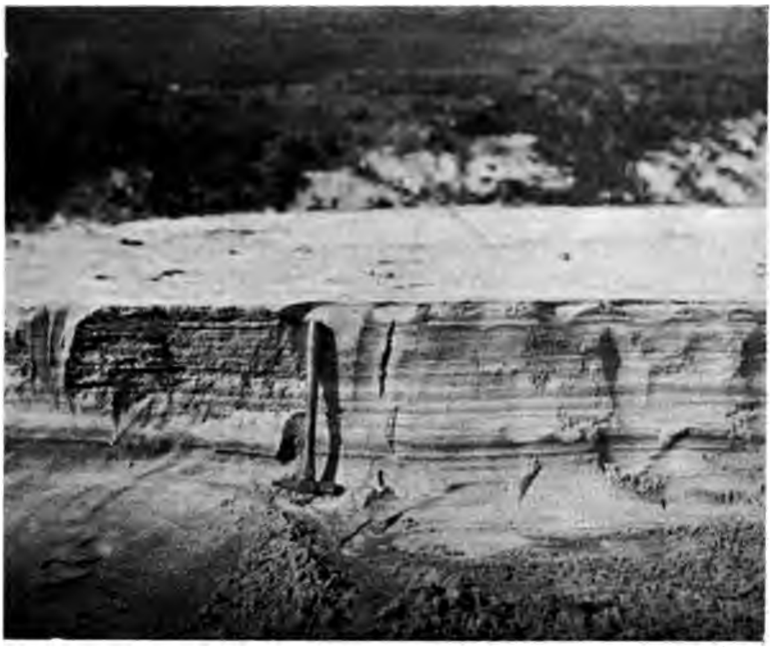
The sand, as in New South Wales, is grouped into long low ridges running parallel to the present beach and separated by flat, sometimes swampy, ground. The dunes in this locality never reach a greater elevation than 20 feet above high-water mark, this being in part due to the great hold which the stunted vegetation has secured upon the sand.

The inference is inescapable, on viewing the ground or the map, that this area was formerly an inlet of the sea into which Cobaki Creek emptied itself. The continual throwing up of sandbars by the combined action of the river and the sea, and the infilling of the lagoons thus formed, account for the reclamation. Such action can now actually be seen in progress at the present mouth of the Tweed River.

It is believed locally, however, that the sea has during the last twenty years encroached on the land at Currumbin Beach from one to three chains.

GEOLOGY.

The only place where anything of the structure of the sand deposits can be seen is in the bank (1 to 15 feet in height) on the upper edge of the beach. As this is continually being broken down the



Photo, L.C.B.

PLATE 1.—BLACK SAND SEAMS EXPOSED IN BANK, CURRUMBIN BEACH.

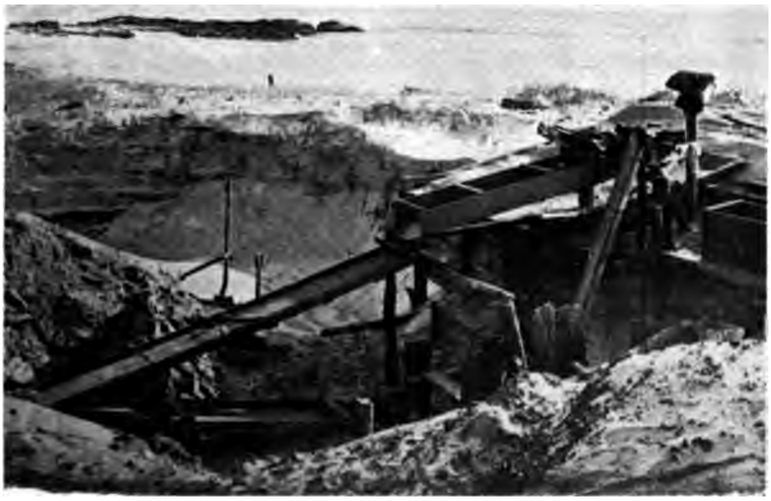


Photo. L.C.B.

PLATE 3.—WORKING WITH SLUICE BOXES, CURRUMBIN BEACH.

alternating layers of black and white sand forming it are exposed to view. The black layers vary from a fraction of an inch to 18 inches in thickness. In a very few places they are entirely absent, but often they are found from top to bottom of the bank, increasing in thickness towards the bottom. (*See* Plate 1.)

The greater part of the beach is, after storms, covered with a layer of black sand, sometimes over a foot thick, but more often only a few inches, in which latter case underneath it are generally alternating layers of white and black sand.

The concentration can be observed in progress. It is due simply to the power of the incoming waves during heavy southerly and south-easterly gales to carry all the finer material (white sand, black sand, tinstone, gold, &c.), to the upper part of the beach, while in retiring they carry off only the white sand. Thus, the black sand tends to increase in the upper part of the beach, and, for the same reason, that part has always proved richest in gold.

In prospecting the surface sands along the beach, it was noticed that the parts richest in gold were those in which brownish tinstone could more readily be distinguished, because of the concentration there being a little "closer."

It is possible that in the beach concentration of the heavier minerals also takes place, as in ordinary stream alluvium, by their sinking through the saturated sands, and causing enrichment of the lower layers, though no proof of this can be offered.

ORIGIN.

The origin of similar deposits in New South Wales, which have been studied to a far greater extent than ours, has not been definitely determined, though many suggestions have been offered.

The ilmenite and magnetite, it may be taken, have been derived from the decomposition and erosion of the basalt sheets which formerly capped this part of the coast (as proved by the numerous outliers still to be seen). That the gold has been derived from the same rock is not beyond the bounds of probability, it having been reported as occurring in diorite in Russia, South Africa, and Victoria. The platinum is even more likely to have occurred originally in the basalt, though its parent rock is believed to be ultra-basic.

It has been suggested that the gold has been derived from reefs in the basal slates. In certain parts reefs—generally almost barren—are very numerous; and again, there are large stretches, as in the locality under discussion, where there are no reefs. Reefs may, nevertheless, have contributed to the supply.

The remaining theory is that the heavy minerals have been carried down from the Stanthorpe-New England tinfields, a distance of nearly 100 miles in a straight line. Even with the fall of 3,000 feet, it is difficult to conceive that the minerals should have travelled such a distance. It is more feasible that they have been derived from rocks, either slates or basalt, in the immediate neighbourhood, in which they occur in too small quantities to have yet been detected.

METALLIC CONTENTS.

Colours of gold were found (in May last) in the black sands on the present beach in almost every spot tested, and the prospects obtained near the old shipwreck, three-quarters of a mile south-east of the Flat Rock (one mile south of Currumbin Creek) were sufficiently encouraging for the ground to be worked, but in September most of the black sand had disappeared. Though the gold may not have been present in payable quantities in the majority of cases, its presence at all certainly pointed to the lower sands being worth prospecting.

Miners now working on the beach affirm that there is, towards Coolangatta Creek, a rich 12-inch layer at a depth of from six to eight feet.

They believe that the seam continues uninterruptedly from Flat Rock, and that it dips south-east along the beach as well as seawards; so that, though above high-tide mark at Flat Rock, it is considerably below at Coolangatta. Owing to the spring tides prevailing, we were unable, in September, to reach the seam more than half a mile south-east of Flat Rock. At that point it is 18 inches thick, and a sample from it assayed (Government Analyst):—

Tin	0.18 per cent.
Gold	12 gr. per ton
Silver	4 dwt. 2 gr. per ton
Platinum	trace.

The above is equivalent to 5.12 lb. tinstone per ton, and it probably equals 1½ lb. tinstone to the yard from the surface.

A mile south-east of Flat Rock there are alternate black and white seams from the surface to four feet depth, with a six-inch seam of black sand at the bottom. A sample from the whole four feet yielded (Government Analyst):—

Tin	0.17 per cent.
Gold	1 dwt. 19 gr. per ton
Silver	3 dwt. 22 gr. per ton
Platinum	trace.

This is equivalent to 4.84 lb. tinstone per ton.

A sample washed here yielded an equivalent to 7.7 lb per ton.

Another sample was taken from a six-inch seam at five feet depth in the bank (at about the level of the highest tide), 1½ miles south-east of Flat Rock, and yielded (Government Analyst):—

Tin	trace
Gold	1 dwt. per ton
Silver	4 dwt. 10 gr. per ton
Platinum	trace.

A sample washed off in the pan yielded 12 gr. to the pound, which is equilavent to 3.8 lb. per ton.

Prospects from a seam in the bank three-quarters of a mile north-west of Coolangatta Creek showed from ⅓ lb. to 1 lb. tinstone per ton.

A sample from a six-inch layer at the surface of the beach at the shipwreck, five-eighths of a mile north-west of Coolangatta Creek, yielded (Government Analyst):—

Tin	0.64 per cent.
Gold	17 gr. per ton
Silver	4 dwt. 20 gr. per ton
Platinum	trace.

This is equivalent to 18.21 lb. tinstone per ton.

The white sand on the beach hereabouts contained from $\frac{1}{10}$ lb. to 4 lb. to the ton, as well as colours of gold.

In order to try and reach the deeper seams, a hole was sunk two chains back in the "terrace," 200 yards north-west of the mouth of Currumbin Creek, but water was struck at a depth of ten feet and prevented further sinking. At eight feet depth is a four feet layer of brown sand, stained by peaty water, and this yielded 3 gr. of tinstone to the pound, equivalent to almost 1 lb. to the ton.

A 15-feet bank, 15 chains north of Coolangatta Creek, yielded traces of tinstone and specks of gold.

The seven-feet bank of brown sand east of Coolangatta Creek prospected ⅓ lb. tinstone per ton, but probably contains many times as much. At this spot there are several thin seams totalling 18 inches, two feet under the beach, prospecting $\frac{1}{10}$ lb. per ton.

At the mouth of Flat Rock Creek, a few chains north of Flat Rock itself, and at the bottom of the bank is a four feet band of black seams, which prospected ¾ lb. per ton, and assayed (Government Analyst):—

Tin	0.26 per cent.
Gold	1 dwt. 7 gr. per ton.
Silver	7 dwt. 2 gr. per ton.
Platinum	trace.

This yield is equivalent to 7.39 lb. tinstone per ton.

(For other assays see under "Workings.")

WORKINGS.

Two claims were, at the time of my first visit, held at the north-western extremity of the beach, near Flat Rock.

In one, just pegged out, a hole had been sunk to the " wash " but had been filled up again through the sea breaking-in.

The other claim, about two and a-half chains south of Flat Rock, had been worked for some months, and had lately changed hands; so that the owners, having put through only four loads, could give me little information as to the contents of the ground.

A 12-inch seam of black sand and a two-inch seam a few inches below it yielded the gold, and to get at them it was necessary to remove six feet of overburden (black and white sand in alternating layers). The seams dipped seaward at a slightly greater angle than the present beach.

A few pounds of the sand were taken from the face of the seam exposed—only a few feet in width—and the Government Analyst found traces of gold and silver, but no platinum. It is, however, recognised that the platinum does not occur distributed througout the whole of the sand, being often conspicuously absent during many days' work.

A small sample of the tinstone, monazite, and platinum concentrates was seen, in which the platinum amounted to many ounces to the ton.

At the time of my second visit (in September) the miners, still working in the same locality, about two and a-half chains south of Flat Rock, had combined, and pegged out the whole of the beach between Coolangatta and Currumbin Creeks as a dredging area. The width of the area north of Flat Rock is only about three chains, while southward it extends back five to ten chains, to the railway line.

A hole had then been sunk in the " terrace," two chains back from the beach, to the west of the workings. At five feet depth it passed through a four-inch seam of black sand (reported to carry 12 gr. of gold and platinum), 15 inches grey sand (with tinstone), and 17 inches black and white sand. A sample from the whole three feet, including black and white sand, assayed (Government Analyst):—

Tin	trace
Gold	5 gr. per ton
Silver	3 dwt. 22 gr. per ton
Platinum	trace.

These seams, though on about the same level, have been proved by the miners to be distinct from those worked on the bank just above the beach.

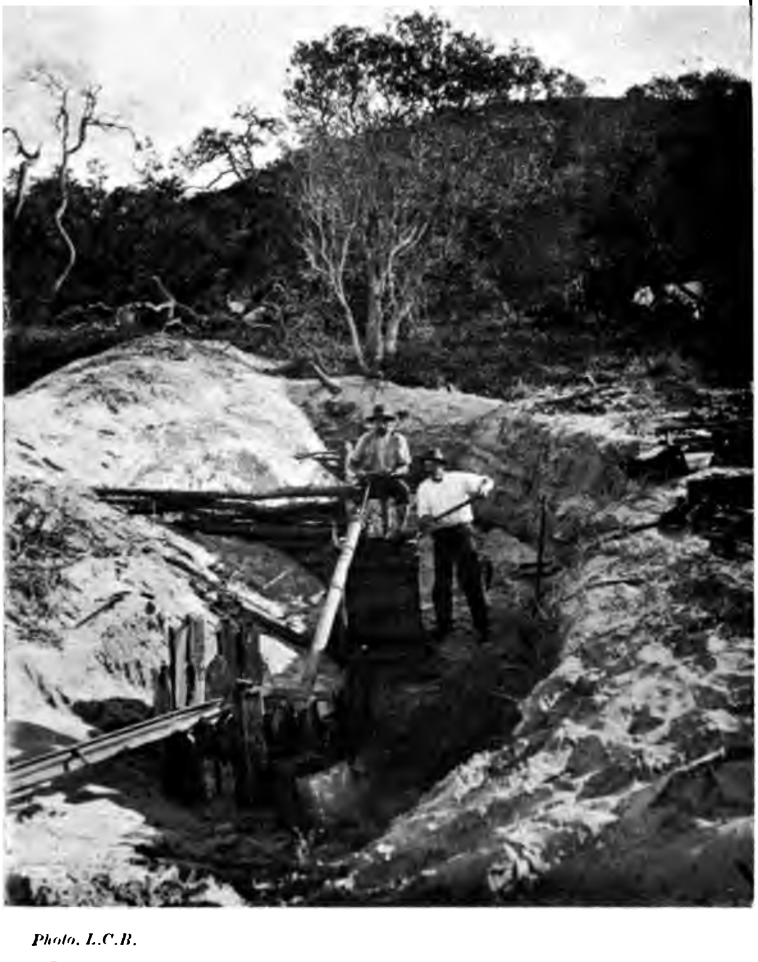


Photo. L.C.B.

PLATE 2.—WORKING WITH COPPER PLATE- AND BLANKET- BOX, CURRUMBIN BEACH.

7.

In the present workings, near the edge of the bank, their main seam (12 inches to 15 inches thick) is six feet deep. A sample from the seam where exposed yielded (Government Analyst):—

Tin	0.12 per cent.
Gold	trace
Silver	3 dwt. 12 gr. per ton
Platinum	trace.

This is equivalent to 3.42 lb. tinstone per ton.

Just beneath it is a thin seam two inches to six inches thick, generally very rich in gold, while about a foot above it is a four-inch, practically barren, seam.

About three chains south-east of the paddock there is a four feet seam of black platiniferous sand at five feet depth, a sample from the upper part of which contained (Government Analyst):—

Tin	trace
Gold	5 gr. per ton
Silver	4 dwt. 22 gr. per ton
Platinum	trace

TREATMENT.

In prospecting, very great difficulty is experienced in saving the gold, platinum, and tinstone, owing to their extreme fineness and the high specific gravity and comparative coarseness of the associated minerals. For this reason it is practically useless to attempt to estimate the contents by vanning, especially of samples weighing more than two pounds. Accurate results can, therefore, be obtained only by chemical analysis.

The treatment employed till quite lately consisted in passing the auriferous sand over copper and blanket tables, the arrangements shown below being employed. The black sand was thrown into the perforated hopper, and sea water, pumped on to it, carried it through to the spreading tray and over a mercury feed-riffle on to the copper plate, and thence on to the blanket table. The tailings then passed into the sump box, out of which they were shovelled on to the dump. (See Plate 2 and Fig. 1.)

Most of the gold was caught on the copper plates, while platinum, tinstone, and monazite remained on the blanket table, where it was

Queensland.

DEPARTMENT OF MINES.

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an increased turnover, closer concentration, and consequently a greater profit, enabling more thorough prospecting to be carried out with a view to the ultimate dredging of the ground.

For the treatment of the sands between tides the surf washer described in the "Mining and Scientific Press" of San Francisco, and the "Queensland Government Mining Journal"* from which the accompanying illustration has been taken, should give good results.

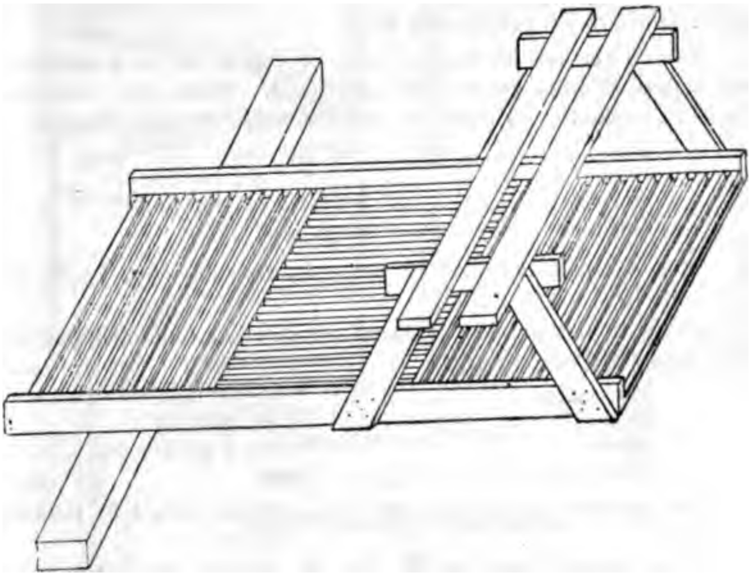

FIG. 2.—SURF WASHER FOR BEACH SANDS.

The sluice box is 8 to 12 feet long and 3 or 4 feet wide, with sides raised 2 or 3 inches above the riffles, which are divided into sections for cleaning up. Amalgamated copper plates may also be used, and quicksilver should in any case be placed in the riffles. The box (inclined 1 in 14 to 1 in 18) is weighted down, within reach of the waves, by sand bags on the crosspiece at one end and the raised platform at the other. The riffles shown are square in cross-section, but they would probably give better results if cut back beneath on both sides, so that their cross-section would be trapezoidal.

PROSPECTS FOR SLUICING OR DREDGING.

It is recognised that it does not pay to work the seams as at present with sluice boxes, but it is held that, with a pump and engine on the ground, the most laborious part of the work (carrying water from the surf and raising it to the tables) will be obviated, and there seems to be every probability of the work being profitable, especially if, as proposed, a horse and scoop be employed also.

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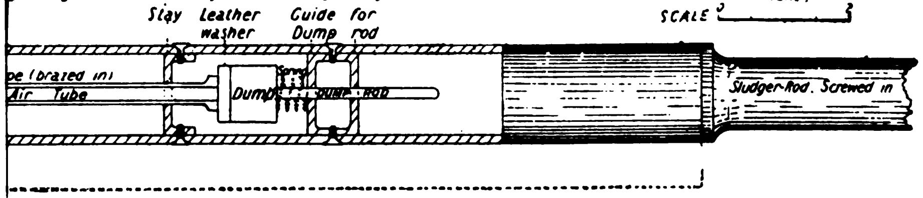
* Vol. IV., 1903, p. 643.

y Reginald W. Laidley Consulting Engineer



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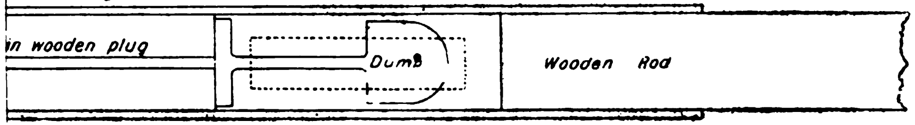

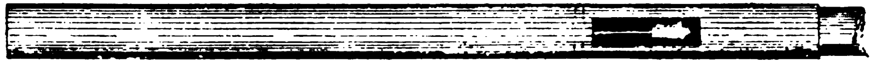

n pipes SCALE 0 1 2 3 4 INCHES

The results thus far obtained indicate this to be a very favourable field for a dredger. The matter should, however, before installation of expensive plant, be put beyond doubt by a thorough prospcting by boring. The contents might be ascertained by putting down bores, 100 feet apart, over the whole area, but a preliminary test might be made with one bore to every ten acres.

Mr. Joseph E. Carne, F.G.S., Geological Survey of N.S.W.* has briefly described and illustrated sludgers used in prospecting in New South Wales. (Fig. 3.)

Those made locally consist of a section of gaspipe, tempered and fitted with two rectangular opposite openings near the upper end, and a perforated wooden plug valve and metal dump. Lining tubes for the sludger holes consist of two lengths of gaspipe or ordinary galvanised spouting of a slightly larger diameter than the sludger barrel. A chisel-shaped cutter might be affixed to the upper end of the sludger rod to facilitate passage through hard bars. The sludger rod is of light pine, and 16 feet to 18 feet in length.

An improved sludger, designed by Mr. R. W. Laidley, of Sydney, consists of a short steel barrel, about 2 feet long and 1½ to 2 inches in diameter, fitted with an air-tube and spring dump, or a ball and clack valve.

The sludger is worked like a jumping rod, the fall of the tool being followed by a semi-rotary boring motion. In prospecting with the machine a hole is sunk 3 feet deep, in which a man can stand and gradually press the lining tube down with a semi-rotary motion. When two lengths of lining tube are used the shorter is first put down to the level of the 3-feet hole, and then withdrawn by means of a rope, and the longer inserted, this procedure obviating the erection of a raised platform.

The simpler sludger first described has been tried at Currumbin, and is found to work satisfactorily in dry sand, though it is almost as quick to sink by shovel down to depths of 14 feet. It, however, failed entirely when the sand contained water. For such ground it will, therefore, be necessary to affix a rough clack-valve to the interior of the bottom of the cutting pipe. This will open to allow the sand and water to enter, but fall back, retaining the material as the sludger is raised.

Special experiments will have to be carried out to determine some method of saving the valuable minerals—the gold, platinum, tinstone, and monazite; for, as already mentioned, their extreme fineness has caused much trouble in separating them from the heavy black sands. Magnetic separation should give good results as far as the gold, tinstone, and monazite are concerned, but the platinum, being generally ferriferous and magnetic, would be carried away with the ironsand.

---

* Annual Report of Department of Mines and Agriculture, N.S.W., for 1895, p. 158.

OTHER OCCURRENCES.

It may be as well here to note that black sands occur at numerous points on the Queensland coast between Currumbin and Burleigh Heads, from Burleigh Heads to Southport, at the north and south ends of Stradbroke Island, at Noosa, and at Geraldton.

Auriferous beach sands have been worked on the North Coast of New South Wales, as described in Appendix A.

In New Zealand the sands are on tertiary terraces (and in the streams intersecting them), on raised terraces (some of which are over 200 feet above the present sea-level), and on the present sea beaches. On the North Beach, five miles from the Maori River, platinum is found associated with gold.

It is believed that the non-success in the dredging of the New Zealand beach sands has been chiefly due to the employment of dredging machinery designed for totally different conditions.

Beach sands have also been worked for gold in Oregon, U.S.A., and Hakodaki, Japan.

Brisbane, 2nd November, 1904.

APPENDIX I.

The Beach Sands of New South Wales.

Discovery.—The discovery of gold in the beach sands of New South Wales was made in 1870, and was followed by a rush of miners from New Zealand.

Extent.—Though auriferous sands are found from the Queensland border to Port Macquarie, and again in the vicinity of Wollongong, the richest localities are in the North, near Byron Bay, Broken Head, and Evans Head, where the yield was up to £800 per man for six or nine months' work.

The mining has always been of an intermittent character, as the ground depends for enrichment on the south-easterly gales.

The deposits at the Evans River have been described* in detail by Mr. G. A. Stonier, F.G.S. After referring to the streaks of black sand on the present sea beach, and in a slightly raised sea beach covered by from 3 to 16 feet of drift sand, he goes on to describe those in the "back terraces."

McAuley's lead, one of these lying three-quarters of a mile inland, was discovered in 1895. It occurs on the eastern side of a long narrow sand dune, its workable width being from 14 to 30 feet. The line of claims was two miles long, the southern extension being poor. The black sand layer on the western side of the lead is a streak, but increases in thickness and decreases in richness towards the east.

---

* Records of the Geological Survey of New South Wales, Vol. IV.

Mr. Stonier favours the idea that the slates have been the source of the gold.

Contents.—The sands contain rounded grains of ilmenite, magnetite, zircons, quartz, and cassiterite, with small scales of platinum, iridosmine, and gold. The platinum is generally present in traces only, while the gold varies from a trace up to 1½ oz. per ton.

The characteristics of the sand are its high specific (4.42), its fineness, and its dark colour.

The concentrates contain from 20 oz. per ton, up to 43 per cent. platinum, and up to 51 per cent. cassiterite.

The amount of gold produced up to 1891 was 400 oz.

Origin.—Mr. J. E. Carne, F.G.S., Geological Survey of New South Wales, discusses* the following possible sources of the gold, platinum, and tinstone in the sands:—

(*a*) The underlying Siluro-Devonian rocks which contain poor quartz reefs.

(*b*) The Clarence Coal Measures.

(*c*) Drifts under basalt, known to occur and to be slightly auriferous.

(*d*) The basalt, doubtful crushings reported.

(*e*) The drainage channels from New England.

Mr. Carne inclines to the opinion that the earlier drainage channels (the drifts), as well as the present, have fed the auriferous beaches.

APPENDIX II.

PHYSICAL PROPERTIES, SOURCES, AND USES OF PLATINUM.

Physical Properties.

Platinum is a steel gray, lustrous, highly malleable, and ductile metal, crystallising in the cubic system.

Native Platinum consists of an alloy in variable proportions of platinum, iron, iridium, osmium, &c., its specific gravity varying accordingly between 13½ and 19, and its hardness between 4 to 4.5 (*i.e.*, a little greater than calcite). Both magnetic and non-magnetic varieties are found, the specific gravity of the former being the lesser, while its hardness is greater (up to 6). Its magnetism is probably due to the high percentage of iron.

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* Records of the Geological Survey of New South Wales, Vol. V.

The metal is quite infusible in ordinary furnaces, and is soluble only in *aqua regia* (a mixture of hydrochloric and nitric acids).

Native iridium is a silver white alloy of iridium with platinum, &c., occurring with platinum in the Urals and in Brazil. Its hardness is 6-7 (felspar to quartz), and its specific gravity is about 22.75.

Iridosmine is a tin white, lustrous, but only slightly malleable alloy of iridium and osmium, generally containing rhodium, platinum, ruthenium, &c. Its hardness is between 6 and 7, and its specific gravity varies from 19.3 to 21.12.

On heating with nitre, oxidation of the osmium takes place. The mineral occurs with platinum in South America, in the Urals, in New South Wales (Bingera, Bathurst, &c.), and abundantly in the auriferous beach sands of Northern California (bright lead-coloured scales); and it is also found in Canada.

Sources.

South America.—The first record of the occurence of platinum dates from the year 1735, when the metal was brought by a Spanish traveller from South America, having been found associated with iridium, osmium, palladium, gold, copper, and chromite in the sands of the Rio Pinto, near Popayan, Colombia. It derives its name from the Spanish plata (meaning silver) in reference to its colour and lustre.

Its occurrence in Brazil was reported in 1826, it being said to occur in syenite.

Europe.—In 1822, platinum was discovered at Nizhni Tagilsk, in the Urals, in alluvial. It also occurs with chromite in serpentine, which is believed to be an altered peridotite.

In Lapland also, where it is associated with the diamond, it is thought to have been derived from a chrome-bearing serpentine.

It has been found in sands in Wicklow (Ireland), on the Rhine, in France, in Honduras, and in San Domingo.

North America.—Platinum has been found in Alaska and British Columbia in auriferous wash, in Quebec, in North Carolina, in California, and in Oregeon (beach sands).

Australasia.—Platinum has been reported from Borneo; from New Zealand (in drift in the River Tayaka, in a serpentine and dunite region, and the Gorge River, in quartz lodes in the Thames region, and in the auriferous sands of North Beach, five miles from the Maori River); and from New South Wales (*in situ* near Broken Hill, and in the auriferous beach sands of the North Coast, as described in Appendix I.).

Uses.

The greater part of the supply of platinum is used in the manufacture of crucibles, foil, and wire, its infusibility and comparative insolubility rendering it indispensible to chemists.

It is employed generally as an alloy in various parts of mechanical instruments of precision, where either permanency or hardness is required. As an alloy it is also used for tipping the nibs of fountain pens.

The metal is employed to a large extent in electrical industries—for fusing in glass, its coefficient of expansion being almost exactly that of glass, so that no disconnection takes place through change of temperature. Platinum has also been used for the filament in electric glow lamps, and for electrodes.

It is used in photography to a slight extent, and it has in the past been employed in Russia for coinage.

By Authority: George Arthur Vaughan, Government Printer, William street, Brisbane.

J C Brow

Queensland.

DEPARTMENT OF MINES.

Geological Survey of Queensland.
PUBLICATION No. 199.

PRELIMINARY REPORT

ON

RECENT DISCOVERY OF GOLD AT OAKS VIEW,

NEAR

ROCKHAMPTON.

(WITH 2 PLATES.)

By LIONEL C. BALL, B.E.,
ASSISTANT GOVERNMENT GEOLOGIST.

BRISBANE:
BY AUTHORITY: GEORGE ARTHUR VAUGHAN, GOVERNMENT PRINTER, WILLIAM STREET.
1905.

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1905.

LETTER OF TRANSMITTAL.

Geological Survey Office.
Brisbane, 23rd January, 1905.

SIR,—I have the honour to forward, under separate cover, my Report "On the Recent Discovery of Gold at Oaks View, near Rockhampton," with one plan and two plates.

I have, &c.,
LIONEL C. BALL,
Assistant Government Geologist.

The Under Secretary for Mines.

L.C.B., Photo.

PLATE 1.—OAKS VIEW HILL *(from the west).*

L.C.B., Photo.

PLATE 2.—MAIN WORKINGS, OAK VIEW.

RECENT DISCOVERY OF GOLD AT OAKS VIEW, NEAR ROCKHAMPTON.

LOCALITY.

Oaks View Hill lies nearly in the centre of grazing farm No. 1v, Canoona, four miles north of the Oaks Station. It is distant, by road, 45 miles from Rockhampton, *viâ* Yaamba, Junction Hotel, Canoona, and the Oaks Station; or, instead of the last, *viâ* Isla Park. The new route to the mines passes Isla Park, keeping to the main Broadsound road till within three miles of the hill. The main road is kept in excellent condition, but the country between it and the hill consists of both broken gullies and black soil flats, and the latter will give great trouble in wet weather. However, there is an alternative route leaving the Broadsound road some miles further to the north, and this, though longer, will prevent absolute isolation.

TOPOGRAPHY.

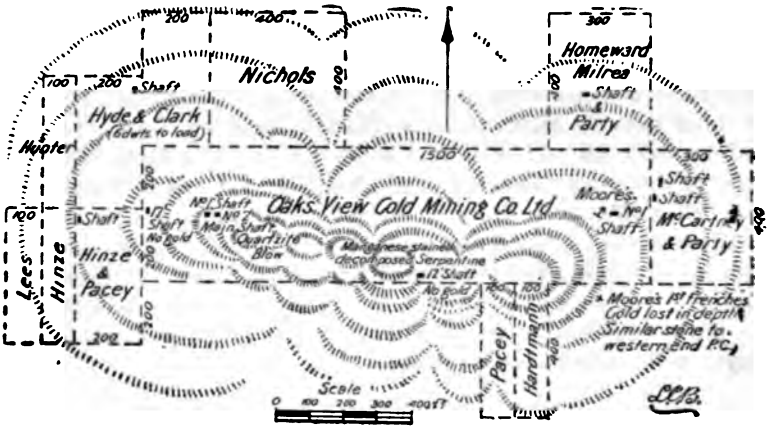
The hill itself (*see* Plate 1), which is about half a mile long and one third of a mile wide, rises only about 150 feet above the black soil swamps on the south, already spoken of. The low melon-hole country on the north and west gradually passes from the flat state into undulations, ridges, and hills, in which the rocks are chiefly quartzites and schists. Though quite isolated from these ridges the Oak View is not the only hill outstanding in the flats. The occurrence of quartzite, which is found intimately connected with the ore deposits, accounts for the resistance of the hill to denudation.

DISCOVERY AND HISTORY.

Mr. W. S. Thomason, in October, 1903, discovered gold by surfacing on Oaks View Hill, but did not proceed further in the matter till February, 1904, when he showed the place to a party of relatives and friends, with the result that payable gold was reported to the Rockhampton Warden in March of the same year. A reward claim (500 by 400 feet) and the usual ground (100 by 400 feet) per man were allotted in due course.

The returns of gold announced being somewhat sensational, a small rush took place. The ground on the east of the reward claim was taken up by Moore's party, who on discovering gold amalgamated with the original prospectors, the combined claims, known as the Oaks United, consisting of eleven men's ground, running east and west for 1,500 feet along the assumed line and north and south for 400 feet across it.

The Oaks United was, at the end of 1904, floated into a company (the Oaks View Gold Mining Company, Limited), with a nominal capital of £24,000, divided into 48,000 shares of 10s. each, of which 24,000 were issued fully paid up, and the remainder as paid up to 5s., this giving a working capital of £6,000.



ROUGH SKETCH PLAN OF OAKS VIEW CLAIMS.

Other claims (*see* Sketch Plan) had been taken up on the north, east, and west of the reward claims, but payable gold had, at the time of my visit, been found on none of them, with the possible exception of Hinze and Pacey's.

TREATMENT.

Treatment thus far (in the beginning of November, 1904) had consisted in dish-washing and cradling, generally without a preliminary dollying. The tailings at the well amount to five tons; 32 cwt. of the uncrushed stuff had been panned off for 92 oz. of gold, and 1 ton 12 cwt., taken from the tailings, had yielded a return of 12 oz. at Aldershot.

The gold saved by these methods enabled the prospectors to purchase a small Huntingdon mill and cyanide plant, which arrived on the field late in December, 1904; but at the time of my visit excavations were being made for a dam, there being no neighbouring stream of water. There are two shallow wells at the foot of the hill, but the water in them is believed to be entirely surface drainage, and quite insufficient to supply a battery.

OUTPUT.

The total gold saved by the above rough method amounted in December, 1904, to 327 oz. 4 dwt., valued at £3 14s. per oz.

According to reports in the Press, 27 tons of stone were crushed at the mine early in January, 1905, for a yield of 4 oz. 6 dwt. per ton.

This, it is presumed, included the tailings above referred to. It was noted that the battery had to close down after this run because of insufficiency of water.*

THE OAK VIEW GOLD MINING COMPANY.

The reward claim and those amalgamated with it, amounting to a total of 1,500 feet by 400 feet, take in practically the whole of the ridge top and the greater part of the northern slope of the hill.

On the very small amount of work done it is difficult to form any definitely favourable opinion. There is now only one small rich area of ground at the western end of the claim, though gold is known to exist, at least in small quantities, over most of the northern side of the hill, and payable gold has been reported from the eastern end of the claim.

WORKINGS.—The main workings (*see* Plate 2) are near the western end (*i.e.*, at the site of the original discovery), the No. 1 shaft lying about 200 feet from the centre of the western boundary. These include a few square yards of "surfacing," two shafts, and two or three shallow trenches. It is worthy of note that cuttings were made about twenty years ago by a prospector named Miller, who found gold within a chain of the present workings, but in insufficient quantities to pay.

The No. 1 shaft, 4 feet by 6 feet, has been sunk 18 feet in a decomposed gossany material (altered serpentine). The main shaft (No. 2) is 45 feet deep, and lies one chain to the east of No. 1 shaft, with which it is connected by an inclined stope.

The stope has a width of up to 30 feet, two drives opening to the northwards from it, one ten feet and one 20 feet in length. From the former an incline extends 50 feet in the same direction as the stope, which stope continues for about 20 feet below the main shaft. A drive to the north from the main shaft is 50 feet long.

Moore's No. 1 shaft, which, being without a windlass, was inaccessible to me, is at the eastern end of the amalgamated claims, about 60 yards north of the south-eastern corner peg and 18 chains east of the main workings. It is 25 feet deep, and from the bottom an underlie has been carried ten feet to the north-east.

The amount of prospecting done is very disappointing, though every excuse must be made for the holders, whose capital for exploitation had to be derived from the ground worked. No doubt when the mill begins to crush proper prospecting will be carried out.

---

* The total crushings for January are now to hand: 119 tons for 227 oz., or 1 oz. 18 dwt. 4 gr. per ton. The great difference between this and the result of the assays is caused, firstly, by the inclusion of rich "specimens" in the crushing; secondly, by the above mentioned patchy nature of the ground worked; and, thirdly, by the fact that the samples were taken from the surface of the heaps, which it is now presumed consisted chiefly of material last raised from the shafts.

Additional crushings are—March, 380 tons for 130 oz. 14 dwt., or 6 dwt. 21 gr. per ton; and April, 86 tons for 62 oz. 18 dwt., or 14 dwt. 15 gr. per ton.

east. Specks of gold can occasionally be seen in this quartz, and the fact that they are enclosed in the solid is a very favourable sign. A sample of the stone assayed (Government Analyst):—

Gold—11dwt. 4 gr. per ton.
Silver—3 dwt. 19 gr. per ton.

A shaft adjacent to this trench had been sunk 45 feet, and a crosscut to the reef was being opened in country very similar to that in the reward claim. In sinking the shaft several boulders of magnesite, coloured with the faintest tinge of green, were found, the green colour being very probably due to traces of nickel silicate (Noumeite).

Hyde, Clark, and Party.

This claim takes in ground both on the west and on the north of the reward claim, consisting of two claims, each 200 feet by 400 feet.

The shaft, 55 feet deep, lies eight chains north-north-west of the prospectors' workings. It opened on a bed of quartzite three feet thick, passing out of it at 50 feet depth, where the thickness is six feet, the dip being about 45 degrees to the north. Below the quartzite is a soft, gossany, quartz-veined material, like that in the reward workings, but carrying only a few colours of gold, so far.

Nichols and Party.

Nichols' claim adjoins the reward claim on the north, and Hyde and Clark's on the east.

A shaft, four chains from the main workings, was being sunk in soft, decomposed serpentine, the changes in which appear to dip west-north-westwards at an inclination of 1 in 6. This may be only a local dip, that in the reward claim being 1 in 2 to the north-north-east.

The shaft was 35 feet deep when seen, and it was hoped to strike the auriferous formation of the reward claim within 150 feet from the surface, to which depth the party is prepared to sink.

Of course, it is impossible to say that the dip of the footwall in the reward claim will remain constant, but the sinking of this shaft is justifiable as a means of prospecting the ground.

McCartney, Rea, and Watson ("Morning Star").

This claim, 200 feet by 400 feet in area, is at the eastern end of the company's claims.

A shaft is now being sunk 1½ chains from the north-western corner peg in the expectation of striking, within 50 feet, a quartz reef outcropping to the south; the country is iron-stained, altered serpentine, carrying flakes of green chrome-bearing silicate and bunches of slightly pyritous quartz.

Another shaft, 30 feet deep, a chain south-south-west of the above, struck, at seven feet depth, a reef 6 to 15 inches thick, dipping 45 degrees to the north. Beneath this is eight feet thickness of country replaced to a greater or less extent by quartz, which, though promising in appearance, yielded (Government Analyst) on sampling only traces of gold and silver.

Homeward, Milrea, and Party (" Last Chance").

The claim, 300 by 400 feet in area, lies on the north of the company's ground at the eastern end.

Quartz-bearing country (with reported traces of gold) dipping 1 in 2 horizontally to the north-north-east, had been just struck at the bottom of a 36 feet shaft, the material between 32 and 36 feet depths agreeing in physical characteristics almost exactly with the ore in the reward claim.

Pacey's and Hardtmann's.

These two claims had lately been pegged out on the southern side of Moore's old claim, though it is generally agreed that gold does not occur on the southern slopes of the hill, where these claims lie.

Hunter's.

Hunter's claim, 100 by 400 feet, is on the western side of Hyde and Clark's.

Fragments of manganese-stained quartz lie scattered over the surface for some three chains, commencing about a chain north of the line of strike of the reef in Hinze and Pacey's claim. One outcrop appears to run north-westwards; but as only one or two small trenches have been opened, and as they show only decomposed serpentine, nothing definite can be seen. It is, nevertheless, inferred that this reef is a faulted portion of that in the latter claim.

23rd January, 1905.

By Authority: George Arthur Vaughan, Government Printer, William street, Brisbane.

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Parry's and H[illegible]'s.

These two claims had lately been pegged out on the southern side of Moore's old claim, though it is generally agreed that gold does not occur on the southern slopes of the hill where these claims lie.

Hunter's.

Hunter's claim, 100 by [illegible] feet, is on the western side of Hyde and Clark's.

Fragments of manganese-stained quartz lie scattered over the surface for some three chains, extending from a point north of the line of strike of the reef in H[illegible] and Parry's claim. One outcrop appears to run north-westwards [illegible] one or two small trenches have been opened, and as they show only decomposed serpentine, nothing definite can be seen. It is nevertheless inferred that this reef is a faulted portion of that in the latter claim.

23rd January, 1905.

By Authority: George Arthur Vaughan, Government Printer, William Street, Brisbane.

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Queensland.

DEPARTMENT OF MINES.

GEOLOGICAL SURVEY REPORT
No. 200.

The Central Queensland (Dawson-Mackenzie) Coal Measures.

THEIR CONTINUATION TOWARDS THE MACKAY AND NEBO DISTRICTS.

(WITH MAP.)

BY

WALTER E. CAMERON, B.A. (Cantab.)
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THE CENTRAL QUEENSLAND (DAWSON-MACKENZIE) COAL MEASURES.

THEIR CONTINUATION TOWARDS THE MACKAY AND NEBO DISTRICTS.

I.—INTRODUCTION.

The field work for this report occupied the months of May, June, and July of last year. It took the form of a rapid geological reconnaisance of the country drained by the Isaacs River and Funnel Creek and their tributaries, its object being to trace the continuation of the coal measures, at present being prospected along the Central District railway line, northwards, towards those known to exist in the Nebo and Mackay districts, and to map the relations between the two.

The coal beds of the Nebo district had been previously referred to in geological reports both by R. L. Jack* and A. Gibb Maitland†, and their identity with those along the Central line inferred on palaeontological grounds, but the intervening country had never been examined by an officer of the Survey, and the mapping of the beds on the Colony Geological Map was only a guess at the relation between the two districts.

The general geological features of the Permo-Carboniferous coal measures of the Central District had not been in any way elucidated until the district along the Central line was mapped and described by Mr. Dunstan in 1901. Mr. Dunstan's examination extended in a north and south direction along the eastern boundary of the coal measures from a point on the Dawson River some 80 miles south of the line northwards across the line, and for another 60 miles up the Mackenzie River to near its junction with the Isaacs.

In a westerly direction the beds were mapped along the Central Railway for a distance of about 80 miles from their eastermost outcrops.

The results of this survey were published in a report entitled "The Geology of the Dawson River, with special reference to the occurrence of Anthracite Coal," published as No. 155 of the Geological Survey Publications. The map accompanying the report shows the extent of the area examined and the general disposition of the beds.

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* Geological Features of the Mackay District. R. L. Jack. Brisb.: By Auth., 1887. (G.S.Q., P. No. 39.)

† Geological Observations at the heads of the Isaacs, Suttor, and Bowen Rivers. A.G.M. Brisb.: By Auth., 1889. (G.S.Q., P. No. 54.)

In his report on the Mackay district Mr. Jack made the first reference to the discovery of coal of a semi-anthracitic character in Queensland, and published an analysis showing its percentage composition. The analysis is given later on in this report. The coal came from Walker's Creek, about 60 miles south-west of the port of Mackay, and about 10 miles due west of Nebo. The work done by the writer shows that the beds containing this coal are a continuation of those in which high-steaming coals were subsequently found on the Dawson, and traced by Mr. Dunstan to the junction of the Isaacs and Mackenzie River, and consequently shows that the coal resources of Central Queensland are continuous for many miles north of the Mackenzie River. It has also served to define the eastern boundaries of the coal measures, with some attempt at accuracy, for some distance further north than formerly, besides throwing additional light on the general disposition of the beds.

Since 1901, when the first coal seam was discovered in the Dawson-Mackenzie Valley, about 40 miles south of the Central line, prospecting for coal has been carried on by several companies, with the object of locating seams along the railway line. This has resulted in the finding of coal at several places in close proximity to the line, notably at Wallaroo, about 78 miles west of Rockhampton, and also near Blackwater, 108 miles from Rockhampton. The high steaming qualities of these coals, as shown by several tests made by the engineers of H.M. warships, has led to the hope that in the near future Central Queensland will become a large exporter of steam coal.

The fact that coals of high steaming character have been found at such widely separated points (Walker Creek being some 220 miles from the coal beds on the Dawson), and that the beds are continuous between the two places, gives a promising forecast for the great resources of this portion of Queensland in high-class steaming coal.

The accompanying map shows, in as much detail as the time occupied in the journey would allow, the continuation of the lower beds of the coal measures. These outcrop along the eastern margin of the field and were traced from near the junction of the Isaacs and Mackenzie Rivers to the head waters of Cooper Creek, near Mount Britten Goldfield, a distance of about 120 miles. The mapping was greatly facilitated, and rendered more accurate, by the use of an advance copy of a sheet of the four miles maps of unsettled districts, at present being issued by the Lands Department, which was then being prepared for issue, and was kindly supplied by the department. A few additions to the topographical detail have been made wherever they were observed, especially in the matter of roads which have sprung into existence since the survey of the country. A few corrections have also been made in place names where they have recently been changed.

II.—GENERAL GEOLOGY OF THE COAL MEASURES OF CENTRAL QUEENSLAND.

The coal-bearing beds at the head of the Isaacs, and those examined by Mr. Dunstan along the Central Railway line, are shown by the assemblage of fossils found in them to be both of Permo-Carboniferous age, and thus of the same age as the coal measures of Newcastle, Bulli, and Lithgow, in New South Wales. They are thus older than the coal measures hitherto worked in Queensland at Ipswich and Burrum, which belong to the Trias-Jura system. They are, however, of the same age as the coal beds of the Bowen River, lying still further to the north. These latter beds were tested by Government bores as long ago as 1879, and shown to contain several valuable seams of coal. They were reported on in the same year by R. L. Jack*, late Government Geologist; and from them the whole of the coal beds of Central Queensland, from the Bowen River on the north to the heads of the Dawson on the south, and for a width of about 120 miles in an east and west direction, have long been known as the Bowen River beds. They are shown on the Colony Geological Map underlying an area of about 37,000 square miles, occupying the greater portion of the valleys of the Dawson, Mackenzie, and Isaacs Rivers. Their eastern margin has been roughly mapped in by Mr. Dunstan and the author along the western flanks of the ranges which hedge in the valleys of these rivers from the lower coastal country. Their western and southern boundaries, however, have only been roughly guessed at. Along their eastern margin they are underlain by considerably altered quartzites, slates, and schists, which have proved fossiliferous in a few areas close to the Central line, and which have there been referred to the Gympie formation. North of the Isaacs-Mackenzie junction similar altered sedimentary rocks are found to the east of the coal measures, but so far they have not proved fossiliferous. Their highly-developed cleavages and frequent intrusions of igneous rocks stand out in marked contrast to the comparatively unaltered character of the beds in which the coal measures lie. As the Nebo district is approached the intrusive plutonic rocks become more prevalent, till they culminate in the Eungella Ranges, at the back of Mackay, as a belt of granite and diorite some 20 miles in width.

Mr. Dunstan, in his report, divided the Bowen River beds in the Central district into an Upper and a Lower Formation, with an unconformity between the two. The Lower Formation he divides into four series, all conformable with each other, but distinguished by palaeontological features from each other. They are as follow:—

1. Upper Freshwater Series, with glossopteris and other plant remains.
2. Upper Marine Series, with marine fossils.
3. Lower Freshwater Series, with glossopteris.
4. Lower Marine Series, with marine fossils.

---

* On the Bowen River Coal Fields. R.L.J. Brisb.: By Auth., 1879. (G.S.Q., P. No. 4.)

scrub. Near the head of Yatton Creek, about two miles south of the old goldfield, the limestones of the lower marine series were again met with.

They form here a series of low scrubby hills, the varied character of the vegetation on the limestones standing out in marked contrast to that of the open forest timber of box and ironbark found on the less fertile ridges of igneous and metamorphic rocks lying to the north and east. They contain here the same abundant marine* shells and crinoid stems as are found further south. The older rocks of the goldfield and along the heads of Lotus Creek consist mainly of diorites and porphyries, with some outcrops of slate and gneiss. About three miles west of these hills, on the Yatton to Croydon road, ferruginous shales and sandstone, showing fern impressions and apparently of the Lower Freshwater beds, were met with two miles south of Yatton station. Thin even-bedded shales and sandstones with gentle westerly dips are found overlying crumpled and twisted slates, showing marked cleavages perpendicular to the bedding. The latter are evidently of much older date than the former, which were laid down on them since their cleavage was imposed upon them. Otherwise there is little to show that the one series is not conformable with the other.

Similar shales and sandstones are found 18 miles further north, near Lotus Creek station, where they again overlie quartzites and greywackes of the older beds.

From Lotus Creek northward the junction of the Bowen River beds with the older underlying rocks was nowhere observed, the extension of the coal measures being obscured for 60 miles further north, first by the alluvium of the Connors River and Funnel Creek and a wide area of Upper Cretaceous sandstone lying between Funnel Creek and the Isaacs River, and further north by a large area of basalt country forming the open rolling country of Oxford Downs and Fort Cooper stations. The marine sandstones of the Lower Marine beds were again picked up on the road from Nebo to Mount Britten Goldfield, where they are again found with the same regular north-north-westerly strike and south-westerly dip, on the western side of the Eungella and Mount Britten range. They show here abundant spirifer, productus, and other marine fossils of Lower Bowen type.

Soft sandstone and clay shales showing frequent impressions of *Glossopteris* and *Sphenopteris* (?) were found along the Isaacs River above Leichhardt Downs and along its tributaries—Phillips Creek,

---

* Mr. Jack (in his "Geology of Queensland and New Guinea," p. 95) has recorded the following fossils from these beds, which he accordingly refers to the Gympie Formation. The fossils are, however, common to the Marine Formation of the Bowen River Beds, as he shows on page 160 of the same work, and I have no doubt from the stratigraphical relation of the Yatton beds that they belong to that Formation. The fossils are—*Spirifera lata*, McCoy ; *Spirifera Stokesii ; Martinia Darwinii ; Productus subquadratus : Productus*, sp. ind. ; *Aviculopecten limæformis ;* and *Eurydesma*, sp. ind.

North Creek, and Cherwell Creek. These beds no doubt belong to the Lower Freshwater coal-bearing horizon. They lie in gentle undulations, and afford few exposures except along the upper courses of the creeks. They have been denuded down to a peneplain, showing only slight elevations above the general base level of the river, their weathering affording grassy plains and dense brigalow scrubs over wide areas on each side of the river. Between the river and Funnel Creek is a stretch of sandy country drained by Devlin or Rockwood Creek, some 25 miles wide, and stretching 40 miles N.N.W. from its junction with the Isaacs. The few outcrops afforded by this country show horizontal siliceous sandstones, which, in lithological character and general horizontality of bedding, show such great resemblance to the desert sandstones of Upper Cretaceous age, found generally over Queensland that they have been mapped as belonging to that formation.

Several small outliers of the same formation occur to the east of Funnel Creek, while rocks of apparently the same age overlie the lower Permo-Carboniferous rocks over a wide area to the north-west, in the higher ground at the sources of the Isaacs River and Cherwell Creek.

Sandstones and shales containing fern impressions of Permo-Carboniferous facies and showing several outcrops of coal cover a large area along Harvybrandt, Carborough, Walker, Kemmis, and Bee Creeks, all of which drain east and south into Cooper and Funnel Creeks. Around Nebo itself they are overlain along Cooper and Nebo Creek by a sheet of basalt some 70 square miles in area, forming a wide extent of open downs country covered with a rich black soil.

Evidences of former volcanic action in this district are also given by the cappings of trachyte found overlying the heights of the ranges near Mount Britten and at scattered points further south on Mount Donaldson, Mount Landsborough, and the Peak.

A description of the points at which coal has been reported will be reserved till the general geology of the country about Mackay, Nebo, and Mount Britten has been discussed.

IV.—GENERAL GEOLOGY OF THE MACKAY AND NEBO DISTRICTS.

The road from Mackay to the Nebo district passes over low-lying, undulating country, till it reaches the foot of the range which divides the coastal plains from the elevated tablelands drained by the headwaters of the Isaacs and Bowen Rivers. The low-lying country is underlain for the most part by more or less horizontally disposed beds of sandstone and shale, with here and there outcrops of coal and coaly strata. These coal-bearing sedimentary rocks have been traced along the coast, skirting the foot of the range, for about 50 miles to the north and south of Mackay, and with an average breadth of about 15 miles from the coast. On the west they are flanked by the belt of eruptive rocks which constitute the main mass of the range, and form a strip of rough mountainous country some 20 miles in width. This belt of eruptive rocks separates the coal measures of the coast from those at the heads of the Bowen and Isaac Rivers. The coastal beds were early referred by Mr. Jack to his Lower Bowen Formation, on account of their lithological resemblance to them.*

In 1889 they were examined and mapped in some detail for about 30 miles north and south of Mackay by Mr. Maitland.† Remains of the plants *Phyllotheca* and *Glossopteris* were discovered by him near the head of Sandy Creek.

The district was also visited by Mr. Dunstan‡ in 1901, for the purpose of reporting on coal seams at Hazeldean, at the top of the range, and by the writer‖ in 1903, for the purpose of reporting on coal seams found on Black Rock Creek, about 20 miles north of Mackay. Up to the present no coal seams of workable thickness and quality have been found in these beds. The beds are, indeed, so much disturbed by contemporaneous flows of basalt and by subsequent intrusions of granite and other plutonic rocks that they do not hold out very great prospects of ever affording very valuable seams of coal. Their geological age is still a matter of doubt. They have, unlike the Permo-Carboniferous rocks along the Isaacs and Bowen Rivers, been considerably disturbed by intrusions of granite and felsite near the Main Range and at various points over the coastal plain, having apparently been laid down before the intrusion of these plutonic rocks took place. The coal measures west of the range, on the other hand, show no sign of such intrusion, and were apparently laid down after the subsidence of the eruptive agencies noticeable along the coast. These latter beds consequently appear to be of somewhat more recent date than the beds found below the range. The effect of the intrusion of the granite on the sedimentary rocks east of the range is well seen as the range is ascended between Eaton and Hazeldean.

As the range is approached, hills of granite begin to make their appearance. The road sections up the range show outcrops of granite alternating with altered sandstones and grits, which are found right to the top, some 1,000 feet above. Judging from their closely-set joint planes and great variations in dip and strike, these beds have been subjected to considerable movement and pressure. They contain small coal seams, and have afforded plant remains such as *Phyllotheca* and *Glossopteris*, so that they apparently belong to the same coal-bearing series as the beds found along the coastal plain, their elevated position and altered character being accounted for by the movements to which they have been subjected by the intrusion of the granite mass. Intrusive masses of granite and diorite are also shown on Mr. Maitland's map accompanying his report on the district, at Scrubby Mountain, at the head of Bell's Creek, at Mount Vince (near Walkerston), Mount Catherine (near Black Rock Creek), and many other points over the coastal plain. In many cases these intrusive plutonic rocks have disturbed the general horizontal position of the coal measures, and in some cases have metamorphosed the rocks and their accompanying coal beds in a marked degree.

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* On the Geological Features of the Mackay District. R.L.J. Brisb.: By Auth., 1887. (G.S.Q., P. No. 39.)

† On the Geological Features and Mineral Resources of the Mackay District. A.G.M. Brisb.: By Auth., 1889. (G.S.Q., P. No. 53.)

‡ Geological Features of Hazeldean, &c. B.D. Brisb.: By Auth., 1901. (G.S.Q., P. No. 164.)

‖ Geology of Mackay and Bowen Districts (Addition to the). W.E.C. Brisb.: By Auth., 1903. (G.S.Q., P. No. 181.)

As the road passes south-westward from the summit of the range, rough ridges of granite are passed over for the next 20 miles, till the Pisgah Range, forming the divide between Denison Creek and Cooper Creek water, is reached. Immediately west of this the granite gives place to a belt of highly-altered sedimentary rocks, which flank the western side of the granite for some 90 miles further north. Along the junction line of these altered sedimentary rocks and the plutonic rocks are the goldfields of Mount Britten, Eungella, and Normanby. South of the Mackay-Fort Cooper road the western edge of the granite is obscured by the basaltic and alluvial soils of Oxford Downs and Fort Cooper. The geological age of the slates and schists has not been determined, no palæontological evidence being as yet forthcoming. They are, however, from their position and highly-altered character, evidently much older than the Permo-Carboniferous coal-bearing rocks which succeed them further west. Two detached outliers of the same rocks occur within the area covered by the Permo-Carboniferous beds further west. The one lies about 20 miles south-west of Nebo, and occupies an area of about 100 square miles, in which lie the copper deposits of Mount Orange and Mount Flora. The second is situated about 14 miles due west of Mount Britten, and is much smaller. In it are the now deserted copper deposits of Mount Gotthardt.

The lower Bowen Beds succeed the granitic and altered rocks to the west. The lowest members of the series are found in the neighbourhood of Mount Britten, where marine sandstone carrying abundant remains of *Spirifer*, *Productus*, *Martiniopsis*, and crinoid stems outcrop over a breadth of some 2 miles. These beds strike about north-north-west, and dip to the west-south-west at angles of from 30 degrees to 60 degrees. When traced to the south they cut out against the underlying slates and schists, the softer sandstones and shales of the overlying Freshwater Series being thus brought directly into contact with the older metamorphic rocks. They were traced north by the writer as far as Hazelwood Creek, near Eungella Station, and on Mr. Maitland's map (*loc. cit.*) they are shown to form a continuous outcrop about 2 miles in width from here to where they were first observed in 1879 on the Bowen River by Mr. Jack. Mr. Maitland maps the rocks on which these marine beds lie about Nebo and Mount Britten as of Mr. Jack's Lower Bowen Series. My own observations between Mount Britten and Eungella led me to conclude that they are of much older date and the mapping has been altered accordingly. There is in fact a distinct unconformity between the slates and schists of Mount Britten and Eungella and the overlying Lower Marine Series.

The country to the west and south of these beds is underlain by gently undulating sandstones and shales of the coal-bearing Lower Freshwater Series, the outcrops of coal on which are described below.

V.—THE COAL OUTCROPS OF THE NEBO DISTRICT.

Coal seams have been known to exist in the Nebo district for the last thirty years, and Mr. Jack mentions in his report (*opus cit.*, p. 2) that as long ago as 1878 two prospecting shafts were sunk on coal in the bed of Bee Creek, above its junction with Hail Creek. Shafts were also sunk in coal in the bed of Walker's Creek, about 2 miles above its junction with Carborough Creek, and about 10 miles due west of Nebo. These shafts have long since been filled in with sand washed down by the stream, but the top portion of the seam can still be seen in the bed of Walker's Creek, about a mile above the junction. Mr. Jack gave the following section of coal strata in the bed of the creek:—

	Ft.	in.
Sandy shale, with lines of very large ferrugino, calcareous nodules in upper part and lines of ironstone nodules in lower part (*Glossopteris* abundant; also a specimen of *Pecopteris*)	13	2
Laminated fireclay (sometimes sandy)	2	0
Compact fireclay (Phyllotheca abundant)	0	8
Dark shale	0	2
Coal	3	5
Gray shale	0	1½
Coal	0	2
Hard red ironstone	0	3
Coal (bottom not seen)	0	9

A specimen analysed had a specific gravity of 1.38, and contained—

Water	2.99
Volatile hydrocarbons	8.71
Fixed carbon (from hard coke)	84.74
Ash (pale brown)	3.56
	100

Mr. Jack remarks:—"The coal of Walker's Creek is an anthracite containing a higher percentage of fixed carbon and a lower percentage of earthy impurities than any coal of its class known in Queensland or New South Wales. It approaches in composition some of the best anthracite of Wales and Pennsylvania."

No attempt has been made to develop these coals. Their distance from a port (the nearest point of the coalfields being some 60 miles from Mackay) and the difficulties of transport across the coastal ranges between Nebo and Eton will probably prevent their being brought into requisition for the present. Judging from the above analysis, their qualities as good steaming coal seem likely to be highly satisfactory.

The fuel ratio (*i.e.*, the ratio between the fixed carbon and the volatile hydrocarbons) of the above sample is 9.73. This brings the coal within the class often referred to as semi-anthracitic. The uses of such coals are practically the same as those of anthracite, and they are generally known in the trade by that name. In addition to their high-steaming qualities, their value as fuel is enhanced by the fact that they are hard coals, standing rough handling, and removal to long distances without making an excessive amount of slack. They are also not subject to spontaneous combustion under ordinary conditions. They are thus eminently suitable for export to distant localities, and can be stored without rapid deterioration. In addition to this, they give a smokeless fuel.

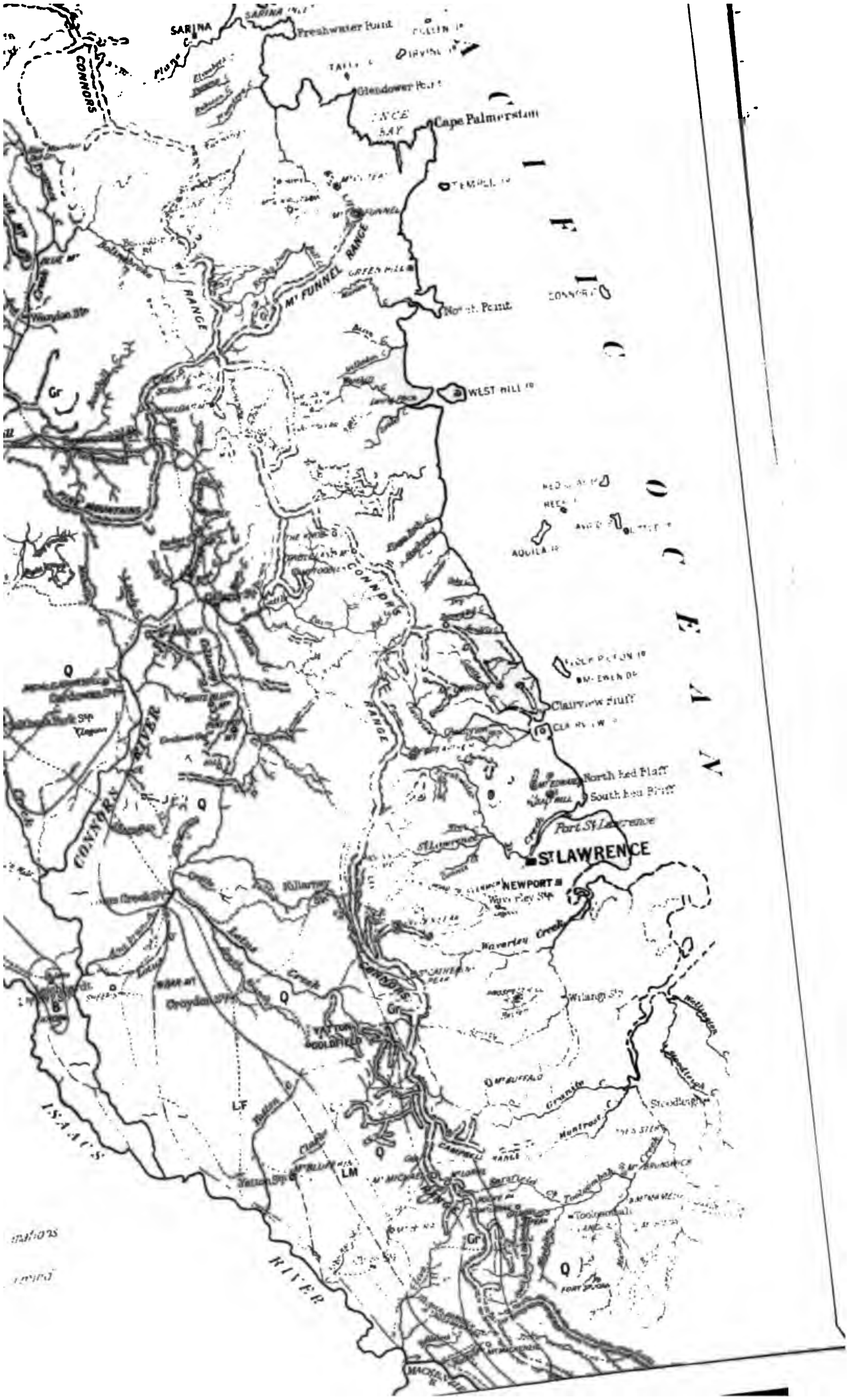
The most favourable area for prospecting lies between Cooper Creek on the east and the Carborough Range on the west, and between Harrybrandt Creek on the south and the head of Hail Creek on the north. The generally slightly inclined character of the beds over this area augurs well for the occurrence of coal at easily worked depths over wide areas. Besides the before-mentioned coal outcrops on Bee and Walker Creeks, coal was observed along the eastern edges of this area as far north as the head of Cooper Creek, at a point about 4 miles due west of Mount Britten and as far south as a point about 3 miles due south of Oxford Downs Station.

Coal crops were also reported to have been seen during the 1902 drought from the head of Bee Creek, near Elphinstone Station, and from near the crossing of the Mackay to Clermont road, about 20 miles further south. These crops were not visited, as they were reported to be covered with sand, and their location and examination would have entailed considerable loss of time.

The level character of the country and general horizontality of the beds do not lend themselves readily to prospecting, so that, in order to give hope of success in locating seams boring will probably have to be freely resorted to; but before anything of the kind is attempted a geological survey of the area in more detail than was considered advisable at the time of my visit should be undertaken.

Geological Survey Office, Brisbane, 6th March, 1905.

By Authority: George Arthur Vaughan, Government Printer, William street, Brisbane.



SARINA
SARINA INLET
CONNORS
Plane C.
Freshwater Point
Glendower Point
Cape Palmerston
TEMPLE I.
Mt FUNNEL
GREEN HILL
Mt FUNNEL RANGE
RANGE
North Point
WEST HILL I.
CONNORS I.
P
A
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AQUILA I.
CONNORS
RANGE
Q
CONNORS RIVER
Clairview Bluff
North Red Bluff
South Red Bluff
Port St Lawrence
St LAWRENCE
NEWPORT
Waverley Stn
Waverley Creek
Killarney Stn
Croydon Stn
YATTON GOLDFIELD
Gr
Wilangi Stn
Mt BUFFALO
Granite
Montrose C.
Styx Creek
Strathbogie C.
Waterloo
Tooloombah
LF
Yatton Stn
LM
Q
CAMPBELL RANGE
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Q
ISAAC'S
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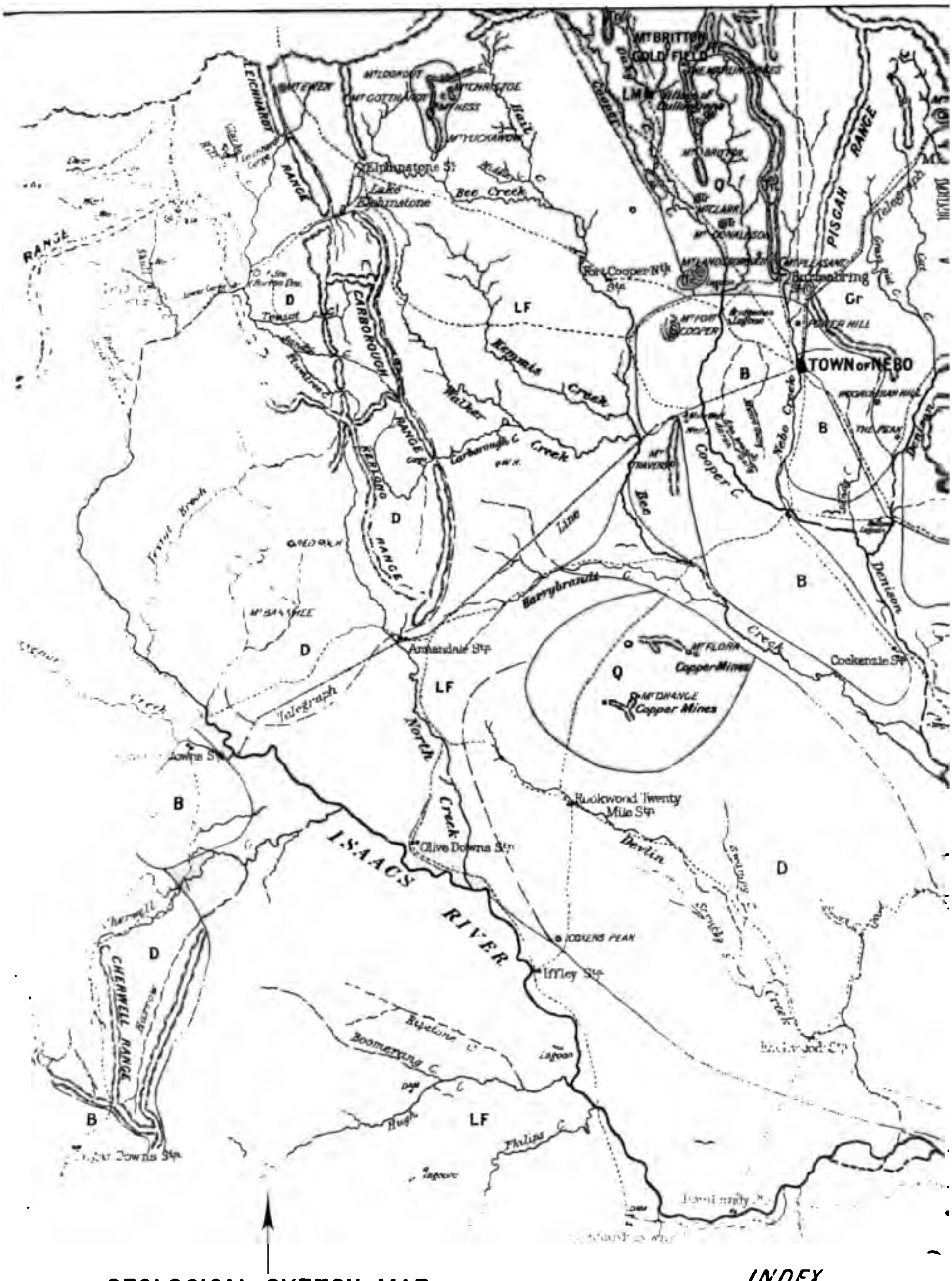
L SURVEY OF QUEENSLAND



GEOLOGICAL SKETCH MAP

OF

Permo-Carboniferous Coal Measures

OF

NEBO DISTRICT

To accompany Report by Walter E. Cameron

Assistant Gov! Geologist

190.

Scale of Miles

INDEX

Recent Alluvium

B Basalt

Tr Trachyte

D Upper Cretaceous (Desert Sandstone

Permo-Carboniferous

LF Lower Freshwater Series (Coal bearing) Bowen River

LM Lower Marine Series

Q Slates, Quartzites & Schists age unc.

Gr Granite

Buggy Roads marked thus

Queensland.

DEPARTMENT OF MINES.

Geological Survey of Queensland.
PUBLICATION No. 201.

BLACK RIDGE, CLERMONT.

I.—Preliminary Report

AND

APPENDICES ON THE STATE OF THE MINERAL INDUSTRY
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WITH 4 MAPS, 12 FIGURES, AND 15 PLATES.

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Preliminary Report on the Black Ridge

(CLERMONT).

◆

I.—INTRODUCTION.[†]

1. LOCATION AND EXTENT.

The Springs Goldfield Extension was proclaimed, in the "Government Gazette" of 1888, to have an area of 12½ square miles. The field is bounded on the north by the scarcely to be distinguished divide (the Drummond Range) between the Burdekin and Mackenzie waters. The Springs Hotel, in the centre of the proclaimed field, lies 11 miles west by north of Clermont, with which it is connected by a first-class road.

A vast amount of work has been done on this old field on lines running north-west and east from the hotel. East of the hotel, work, except that of a few dryblowers, has practically ceased; but to the north-west operations are still being carried on upon a small scale in a few claims. In the extreme north-west are the shallow workings of the Black Ridge, the deeper workings on the same runs being outside the goldfield.

Operations are also going on at the Miclere, nine miles north-north-west of the Springs; at McMaster's, four miles west; at Black Johnson's, two miles north of McMaster's; and at Schnuffler's Dam, 1½ miles west-south-west of Top Camp (McMaster's).

The estimated population at the various centres in 1904 was as follows:—Black Ridge, 250 men; Miclere, 60 men; McMaster's, 25 men; Hurley's, 16 men; Cockatoo Dam, 10 men; Schnuffler's, 6 men; Black Johnson's, 4 men; Scrubby Dam, none; intervening country, a small number.

2. GENERAL FUTURE PROSPECTS.

The Black Ridge and the country northwards is at present the mainstay of mining in the district.

The plateau between Black Ridge, Miclere, and McMaster's is covered almost entirely with basalt or basalt soil, most of which is underlaid by coal measures and auriferous deposits, for such dip under it at the three localities mentioned. The area of the triangle referred to is 16 square miles.

[†] My stay in the Clermont District extended from the beginning of July to the middle of August, 1904, the greater part of the time being spent in the Springs-Black Ridge vicinity. The delay in publication has been due to more urgent departmental matters requiring my attention.

My acknowledgments are due to Messrs. Bacon, Douglas, Ford, Hopkins, Illedge, Jones, McDougall, Noonan, Small, and Young, and to every claimholder approached, for having, without exception, given me every assistance.

It is, however, probable that the auriferous ground will extend to the south, beneath the Blair Athol Collieries and Hurley's Diggings, to the Venus, where similar ground is now being tested.

It is possible that, owing to the storage of water beneath the basalt, the individual miner will sooner or later have to give up the attempt to reach the auriferous ground beneath; but by that time mining companies will have entered the field, equipped to overcome the water in sinking and to work the auriferous gravels on a much more systematic and profitable basis than has yet been done. The fact that the gold-bearing stratum itself is comparatively dry is greatly in its favour.

It will be first necessary to sink bore-holes to test the ground, not only in the Black Ridge-McMaster-Miclere triangle, already referred to, but also on the Blair Athol Coalfield, where the occurrence of thick seams of high-class coal (the ash of which has been proved to be auriferous) above the auriferous beds and capable of being worked from the same shafts, and by perhaps the same methods, would give a boundless supply of power for all mining operations on any scale whatever.

The workings west of the Venus Hotel, in cement ground identical with that at the Black Ridge, prove the continuation of the "cement" in a southerly direction.

3. TREATMENT AND OUTPUT.

Treatment.—Taking the fields as a whole, the material treated consists of (1) surface soil and detritus, (2) ordinary gravels, and (3) conglomerate.

1. The *surface material* is almost invariably dry-blown or dry-jiggered (the finest screen in the dry-jigger being thirty to an inch). It very seldom requires a preliminary drying by fire, owing to its exposure to the tropical sun.

2. The *gravels* are "puddled," whether their nature be clayey or not. The puddlers or puddling machines are erected adjacent to a constant supply of water (a permanent well), and the material is carted to them. There are two puddlers (Murphy's and Walker's) midway between the Black Ridge and the Springs. (Plate 1.)

Treatment, including cartage from Black Ridge to the puddlers (a distance of about a mile), is given as 5s. per ton. The miners, however, supply their own men to do the sluicing, the owner simply supplying plant, power, and water for puddling.

During 1895, 1896, and 1897, 20,000 loads were puddled for an average of 11 dwt. (*Fide* Chas. Young, Esq.).

In exceptional cases, as at McMaster's, the "fines" are washed in a wet-jigger.

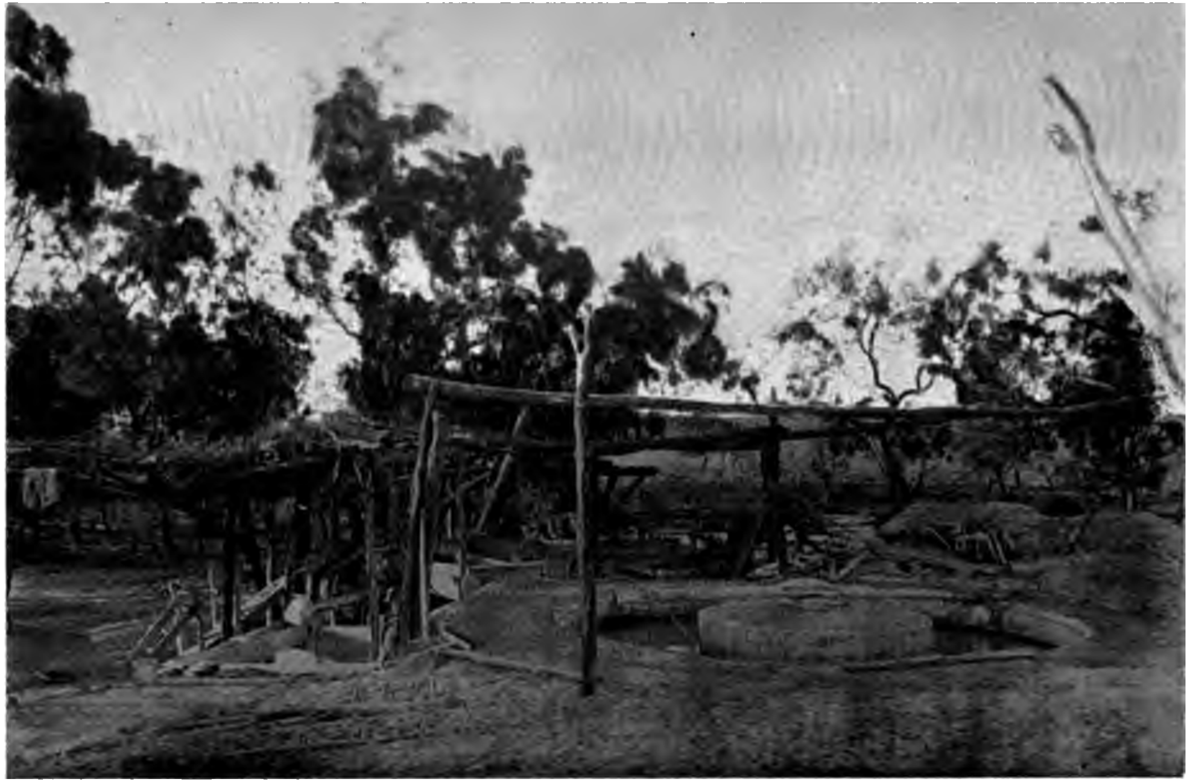

Photo., L.C.B. **MURPHY'S PUDDLER, THE SPRINGS.** **Plate 1.**

SHOWING CIRCULAR PUDDLING TROUGH, RAKES, ETC., AND ALSO SLUICE-BOX.

3. The *conglomerate*, when not "cemented" (hard), is also sent to the puddlers, but as a rule its indurated condition necessitates its going to the stamper battery, where it is put through the same treatment as ordinary reef quartz.

Two attempts have been made to carry on crushing at Cement Hill (Springs). A crushing mill is reported to have been erected in 1887, but was dismantled after crushing 200 or 300 tons for a yield of 2½ dwt. of gold per ton.

There has been a battery near the All Nations Hotel for the last eighteen months, but considerable dissatisfaction has been expressed owing to delays caused by the repetition of break-downs, which, taken with the distance from the claims and the late developments in the deep "cement" ground at the Ridge, have justified the erection of a battery on the spot.

The miners have lately come to terms with a battery-owner, and the erection of a ten-head stamper battery on the Deep Ground is now (April, 1905) complete.

Output.—The two gold-buyers on the field have given me the following information.—Mr. Noonan, during the first half of 1904, turned over an average of 40 or 50 oz. a week, but during July there was a slight falling off, and in August the weekly turnover was only 10 oz.—this being due to the working out of the shallow claims at the head of Gowrie Creek. Mr. Small, in 1903, bought a total amount of 1,200 oz. His buyings in 1904 amounted to only 50 oz. in May, but jumped to 274 oz. in June, owing to the opening up of the Deep Ground. In addition to these quantities, a considerable amount goes direct to Clermont, and no record can be had of it.

The Warden gives the whole alluvial output of the Clermont fields for the year 1904 as 6,876¾ oz., the greater part of which came from the Black Ridge. The value is given as £4 per oz.

4. PREVIOUS REPORTS.

Mr. Dunstan, Acting Government Geologist, in his report[*] on the field, revises previous reports by Dr. Jack[†] and Mr. Rands,[‡] previous Government Geologists of Queensland, but we have not been able to secure reports understood to have been written by Messrs. Clark and Daintree.

Mr. Dunstan's report includes descriptions of the alluvial deposits, the reefs, and the geology of the Clermont district. Numerous localities and leads now deserted and not mentioned here will be found described in it, and quotations from it appear below.

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[*] The Clermont Goldfield, with a description of Dry-blowers and other improvements in Alluvial Gold-saving Appliances. By B. Dunstan, F.G.S., Assistant Government Geologist. Brisbane: By Authority, 1902 (G.S.Q.P., No. 176)

[†] Annual Progress Report of the Geological Survey for the year 1894. By Authority: Brisbane, 1895 (G.S.Q.P., No. 103).

[‡] The Geology and Mineral Deposits of the country in the vicinity of Clermont. W.H.R. By Authority: Brisbane, 1886 (G.S.Q-P., No. 27).

5. MAP.

The field work for the map published herewith was done with aneroid and a Gannet plane-table, with telescopic alidade, fitted with stadia wires, but without an arc for reading vertical angles. With such a plane-table only approximate work could be carried out, and the result is, therefore, little better than an accurate sketch map. The contours give the general configuration of the country, but the slopes on the downs are so slight that it would perhaps have been better to have dispensed with the aneroid, the amount of corrections necessary being altogether out of proportion to the value of the results. A plane-table, such as Johnson's, which is used by the U. S. Geological Survey, could have been used with far greater accuracy, and with a considerable saving of time.

Little time was given to the delimitation of the various geological formations, but it has been possible to sketch most of them in from the points fixed on the traverses. The following explanations are necessary with regard to the various coloured areas shown on the map:—

Basalt.—The areas are mostly covered with black soil, part of which in the gullies may be alluvial. The basaltic area is known in one case (*i.e.*, south-east of the Black Ridge) to extend beyond the limits shown, shafts having proved basalt in sinking; but, the surface soil being light, these extensions could not be marked in with any degree of certainty. Red sintery clay deposits have been sometimes included with the black soil, these deposits having been perhaps derived from the decomposition of basalt.

Actual outcrops of basalt are comparatively scarce, the rock when found being generally dense, with no porphyritic crystals, except olivine. In some cases, as to the northwards of portion 173, its weathering indicates a columnar structure.

It is often noticeable that, on the edge of the black soil downs, the soil has a chocolate tinge, and it is therefore assumed that, when a light chocolate patch occurs out on the downs, it indicates that the coal measures or schists are at no great depth. That there is reason in this is proved by the general occurrence of fragments of quartz with boulders of "billy" and magnesite, in the soil in these patches. Such a belt of soil lies between the Deep Ground and the main Northern road to the south-west, and it is believed to indicate the existence of a "bar" of schist, near the surface.

The black soil downs are generally almost destitute of timber (the exceptions being a few emu-apples, &c.), but where the chocolate tinge appears there is often a thin growth of stunted timber (gum-topped box, bloodwood, &c.).

Schists.—It is seldom that an outcrop of schist is to be seen, except in the watercourses, but, when veined with quartz, the angular

"TISH"

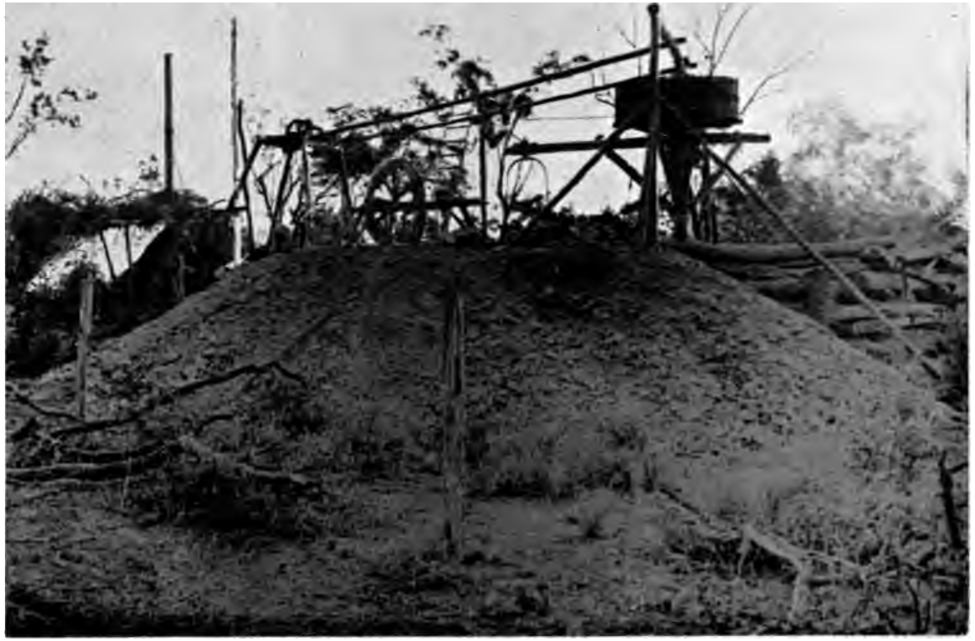

Photo., L.C.B. FRASER'S WHIM, BLACK RIDGE. **Plate 3.**

SHOWING VENTILATING FURNACE ON THE LEFT AND HAND-POWER FAN ON THE RIGHT OF THE POPPET LEGS.

fragments of that mineral in the soil betray its presence. Generally the surface is light and clayey, and, as sometimes the coal measures form a soil identical in appearance, it is often impossible to indicate, after simple inspection, what the rock beneath may be. The schists sometimes form a stiff deep red residual clay, which it is extremely difficult to distinguish from that formed by the decomposition of basalt.

Coal Measures.—These, when consisting of conglomerate, are easily determined. The soil is mostly light clayey, and occasional rounded pebbles of quartz can usually be found in it. When strongly coloured the former extension of a basalt cap is almost certain.

Near the surface the conglomerates, sandstones, and shales of the measures are in most cases bleached white, but in the deeper ground they take the colour of the bedrock—white, blue, green, red, or yellow.

Brigalow and rosewood are here almost a sure sign of coal measures. The Black Ridge itself owes its name to the strong belt of dingy-foliaged brigalow, extending along the outcrop of the auriferous conglomerates.

The formation known as "tish," which occurs towards the base of the coal measures, causes much trouble in determining the boundary of schist and coal measures. As it is formed almost completely of angular and sub-angular fragments of schist, it is not possible to distinguish the division between the two on the surface, unless a section is actually exposed. The "tish" always occurs with, and is sometimes interbedded in, the coal measures, and may, therefore, be taken as belonging to them. Its origin has not yet been worked out, for it is inconceivable that such soft material could form either a talus or a glacial moraine, and the deposits resemble nothing else. (Plate 2.)

"*Billy.*"—This rock is shown on the map only where there are distinct outcrops, though it may possibly underlie large areas of the black soil, and has been proved under a considerable area at the Ridge.

6. VENTILATION.

For ventilating the mines, various plans have been tried at the Ridge. The windsail is, of course, the most common, and consists of a sail causing a current of air to be deflected from the horizontal into a large canvas hose, leading to the bottom of the shaft. On calm days this is useless, and in shaft-sinking two other methods have been resorted to—viz., (1) a hand-power fan to drive a current of air to the men working below, and (2) a furnace erected beside the shaft mouth and connected with the shaft bottom by a line of iron piping, up which the air is drawn to the fire. In the accompanying plate, both the furnace and the old hand fan are to be seen. On reaching "wash" an attempt is always made to connect with adjacent workings, and on breaking through there is no further trouble from the air supply.

II.—THE SPRINGS.

The Springs Extended Goldfield embraces: Cement Hill, Linklater's and Victoria Leads, Leonard's Gully, Christmas Hill, Pewt's Hill, and the shallower workings at the Black Ridge, as well as a number of less important localities given below.

The oldest workings are in about the centre of the field, and will be described later on in detail, though they have now been abandoned by all except a few dry-blowers and an occasional party of fossickers, who clean out an old shaft to re-try the "wash" left standing.

1. CEMENT HILL.

The existence of gold (coarse and rounded) was first proved here in 1865, the discovery being the cause of all the work since done in this direction from Clermont.

The hill, which rises only about 70 feet above Gowrie Creek, lies just outside the north-western corner of portion 47, Apsley, and is within ½ mile of the Main Northern Road and telegraph line, at a point 11 miles west-by-north of Clermont. It is really the end of a low ridge or escarpment overlooking Gowrie Creek on the west.

The strata forming the hill have already been shown by Mr. Rands* to consist of (*a*) a bed of conglomerate of schist and quartz pebbles in a clayey cement, the lower four or five feet of which is auriferous; (*b*) beneath the conglomerate a fine-grained silt and sandstone, one to four feet thick, dipping 5 to 25 degrees west and south-west into the hill, in which Mr. Rands found impressions of Glossopteris; and (*c*) a deposit up to 40 feet in thickness of a "tish" formed of schistose pebbles, and much quartz, less rounded and in a coarser state than the upper gold-bearing "wash."

(A) SURFACING.

The worked ground tails off on the southern side, but practically the whole of the northern and eastern slopes of the hill have been "surfaced."

Prospector's Gully, on the northern side, in which, as its name indicates, the discovery was made, was the richest part of the Hill. From the P.C. it is reported, on good authority, that £2,500 worth of gold was taken, the ground being all shallow.

Still, at odd times dry-blowers may be seen going over the old ground. It is, in fact, the dry-blowers who have done the greater part of the surfacing here as elsewhere, most of the ground being too poor to pay for cartage of the "wash" to water.

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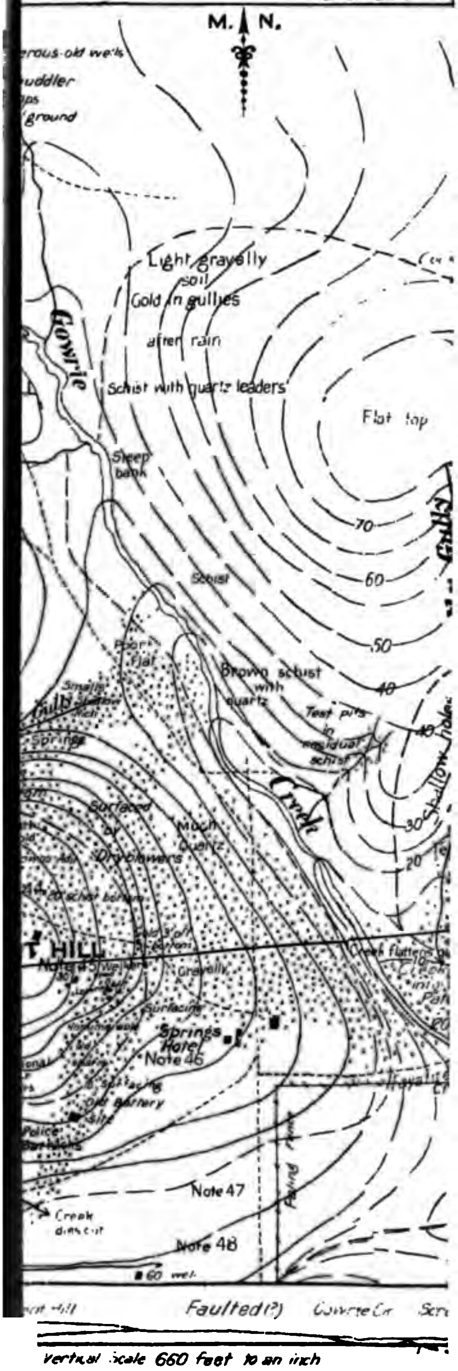
* G.S.Q.P., No. 27.

GEOLOGICAL SKETCH MAP 3
with section
of
THE SPRINGS
(To accompany G.S.Q. report No. 201)
By
LIONEL C. BALL B.E.
Assistant Government Geologist
1905
Scale 10 chains to an inch



Vertical scale 660 feet to an inch

(B) SHALLOW GROUND.

as soon proved, in exposing the bedrock, that the gold had ived from a basal bed of conglomerate, which dipped westto the hill. Sinking resulted as a matter of course, and some nd was worked in the shallower claims, where it is reported lay in north and south "runs." Lorrie's was the only claim the Hill in 1904, but the three adits described below were en to view. They are on the outcrop of the "cement."

ie's.—On the eastern slope of the hill overlooking the Springs

three shafts are—the first, 16 feet deep; the second (50 e west), 33 feet deep; and the third (45 feet further west), 44). A stope has been carried 30 feet westwards from the t shaft, and a drive extends 16 feet to the south from the The sinking is all conglomerate.

"wash," quite free from clay and very coarse, contains pebbles derlying fine-grained "tish" and some granite, the latter quite ed. The pebbles lie more often than not parallel to the bottom.

he "wash" in the western shaft can be seen a three to nine h and south zone, whitened and softened, the zone itself being hough the "wash" in its neighbourhood is auriferous. It is to continue north and south into other claims, and appears to tion channel. In the shallow shaft, between the ordinary d "headlings," there is from three inches to a foot of irontish," one inch of which is rich in gold. This rock is known ock." It thickens and passes into the roof to the west. The ll fine and rough, and is found on the steeper sidlings, the here the bottom is flat, being poor.

treatment, seven or eight inches of "wash" is separated, p, and washed in a dish, for yields of from 12 to 15 dwt. per

westward slope of the bottom of the "wash" (or surface of the ncreases from 1 in 5 at the 15-feet shaft to 1 in 3, and then t the second shaft, the general average being about 1 in 4.

underlying rocks have a much flatter dip in the same direchown by the interbedded fine fossiliferous white shale in the ich, as a matter of fact, differs from the "wash" only in being ed and in containing more schist. This is evidently a case poraneous erosion, with a slight unconformability.

st's (?) Adit (abandoned).—On the northern side of the hill o Prospector's Gully.

dit is believed to have been 1½ chains in length, but is now The run of gold was followed westwards for three chains, and e south.

bedrock at the outcrop is a fine sandstone, dipping 1 in 5 th-south-west.

Brown's (?) Adit (abandoned).—East of the above. After the claim had been thrown up by Brown, a company secured it with the results stated below.

This adit runs into the hill to the south-south-west for 2½ chains, a shaft at the end being 50 feet deep.

The "wash" is coarse and not quite conformable with the bottom, though the separate pebbles are generally parallel to it.

The company broke down six feet of "wash" near the outcrop, so forming a wide chamber, from which they put another drive in to the south-south-west. Several hundred tons were crushed for a rumoured yield of 5 or 6 dwt., which did not pay expenses, and operations were in consequence suspended.

Near the surface the bottom slopes 1 in 5, further in it flattens, but soon again becomes steep.

The bedrock for a chain from the outcrop is a white sandstone, and beyond that is a brown shale.

McGregor's (?) Adit (abandoned).—On the eastern side of the hill. The adit, which is 40 feet in length, was opened nineteen years ago. Mr. Rands mentions that the ground contained, as proved by several months' working, 5 or 6 dwt. per ton, but that it was not then (in 1884) possible to make such an amount pay expenses.

Douglas's (?) (abandoned).—At the head of Prospector's Gully.

The shaft is 35 feet deep, and good gold is reported. Eighteen months' work was done here.

Bottom dips to the west, but gold is reported to have run along a sidling to the south.

Gerard's (abandoned).—Two and a-half chains to north-north-west of Douglas's.

A semicircular area north of the shaft has been worked out. The gold was believed to run to Douglas's claim.

Dr. Jack refers to a Gerard's shaft, 28 feet deep, in which the bottom was grey silt dipping to the south-west, but its position is doubtful.

(c) DEEP GROUND.

A line of comparatively deep shafts runs westwards along the crest of Cement Hill. The "wash," though auriferous (much of the ground containing ½ oz. gold per ton), was, owing to its hardness, not considered payable.

Burn's (abandoned).—At the head of Barracks Gully on the southern side of the hill.

The shaft, 70 feet deep, was sunk at the beginning of 1904.

The "wash" is a red "cement," carrying from ½ oz. up to 2 oz. to the load, and thirty loads were crushed. It is believed that the "pay wash" was worked out.

Bottom appears to have been carbonaceous shale.

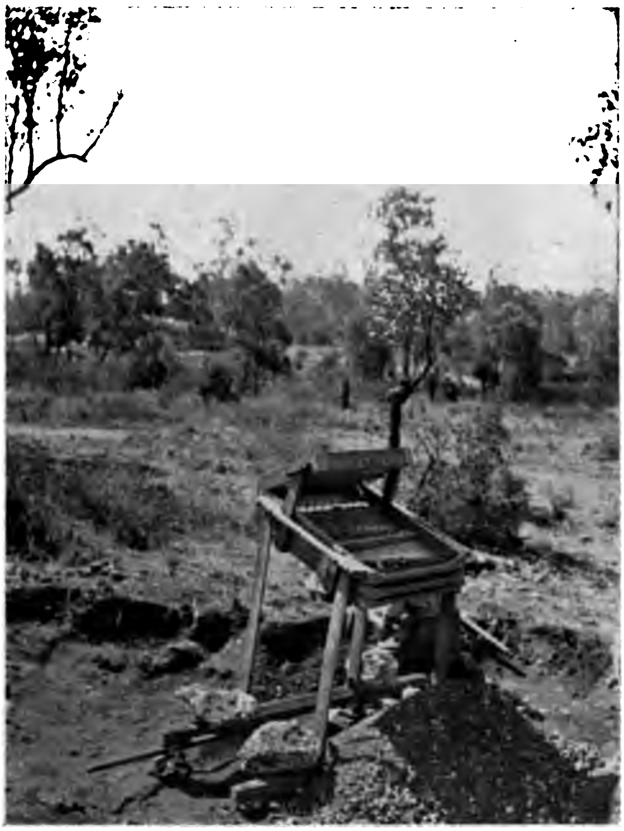


Photo., L.C.B. **Plate 4.**

SURFACING ON LIMESTONE HILL.

SHOWING DRY-JIGGER AND THICKNESS OF GOLD-BEARING SOIL.

2. SPRINGS CREEK.

The extension of the "wash" westwards of Cement Hill, has been prospected on the slopes of a steep hill, on the opposite side of Springs Creek, ½ mile from the former hill.

Craven's (abandoned).—At the foot of the ridge.

The shaft is between 80 and 90 feet deep. The strata pierced include conglomerates, carbonaceous shales, and "tish," while just above the "wash" a seam of coal was cut.

The bedrock is brown slaty schist.

Towards the ridge top, to the south-west of Craven's, there are several abandoned shafts within a circumscribed area, near the boundary of the schists and coal measures. The depth varies from 10 feet to 100 feet, indicating either the presence of cañons or of faulting. Abundant fossil leaf impressions are to be found on the tips.

3. WHITE HILL.

This is really a continuation of Cement Hill, westwards of Prospector's Gully. The deepest shaft at the time of Dr. Jack's visit was 90 feet, and in it the "wash" dirt rested directly on schist.

The claims on the western slope of the hill proved most profitable, and the shafts there, all deserted, are very numerous.

4. McFAYDEN'S LEAD.

This runs north from White Hill, into Gowrie Creek, just below the All Nations Hotel. It was narrow, and the only payable ground was in McFayden's claim, near the lower end.

Some unsuccessful prospecting has been undertaken, with Government assistance, beyond Gowrie Creek, in wet ground, on the prolongation of this lead and the surfacing on Pewt's Hill.

5. LIMESTONE HILL.

This is a low ridge on the right bank of Gowrie Creek, between the battery and the Springs road. The name is due to the deposits on it of "clinker"—a secondary magnesic calcium carbonate derived from the decomposition of the basalt, and proving that its base is not many feet below. The gold is found in from six inches to one foot of dark soil resting on solid "clinker" and mixed with blocks of the same rock. Several dry-blowers have lately been carrying on profitable operations here, and an illustration of one of the machines is shown herewith. (Plate 4.)

6. PEWT'S HILL.

Pewt's Hill lies about ½ mile north-north-west of Cement Hill, and overlooks the All Nations Hotel and battery from the west. Part of the shallow ground on the east was opened thirty years ago.

Dr. Jack noticed that the bottom is slate, and that its depth increases towards the summit, the slope being to the west. Payable gold had been found in the most western shaft. Few shafts have been sunk on the crown of the hill, owing, it is said, to the hard bottom, most of the claims (past and present) being on the south.

Well's and Hill's (formerly Barne's).—South-west of the hill.

The shaft, 95 feet deep, was sunk all in "conglomerate," in 1892. The workings now open consist of drives running 25 feet west-north-west and 30 feet east-south-east from the shaft, and there are understood to be other filled-in drives extending north-north-east and south.

The "wash" is light-coloured and coarse, containing much slate and decomposed granite (soft kaolin-turgite rock), with not a great amount of quartz. Both waterworn and angular gold, with much "paint" gold, are found on flats under the dips.

For treatment five inches of "wash" and five inches of bottom are broken down. A few crushings have been obtained, of 24 and 26 dwt. per ton, from the south side of the shaft. In August, 1904, the following crushing, of stone accumulated during the two previous months, was made:—

19 tons yielded 8 oz.—equal to 8 dwt. 10 gr. per ton.

The bottom appears to slope from the shaft in all directions, at as much as 1 in 5.

Schistose quartzite and clay-schist form the bottom, with "paint" gold on limonite-stained faces, for six inches from the "wash." Lenticular quartz leaders strike east and west, and near them the best prospects are found.

Ringe's (abandoned).—About three chains east-north-east of the above.

The shaft is 92 feet deep.

The gold occurred in trails in the "wash," and also in the bottom, the yield being about 11 dwt. to the load.

Carroll's.—At Ellis's house, five chains west-south-west of Well's and Hill's.

The shaft is 160 feet deep (30 feet of water). It was sunk by Carroll in 1896 to a depth of 116 feet, and then abandoned by him. Bedford continued the sinking, but abandoned it on bottoming.

A current rumour that 18 inches of very hard wash carried 2 gr. to the dish was disproved by Miles and party during my visit.

There is a grey mica-schist bottom.

7. BLACK GULLY.

This is a small depression on the northern side of Pewt's Hill, and the workings on the two are continuous.

8. PINK HILL.

The hill lies north-west of Black Gully, above which a run of gold has been worked.

On the south-eastern slope of the hill gold has been found at 30 feet depth, on a false bottom 10 feet above the schist bedrock.

9. BLACK RIDGE.

The shallower workings at the Black Ridge—*i.e.*, those east of the Drummond Range divide—are included in the Springs Goldfield, but the description of them will be placed under the third general heading "Black Ridge."

10. LINKLATER'S LEAD.

Linklater's lies on the spur upon the eastern side of Gowrie Creek, opposite the Springs Hotel.

A surface "run" was followed, thirty years ago, south-south-eastwards down a steep ridge from the summit. Near the ridge top the "dirt" was a couple of feet deep and two chains wide, but down the hill the depth increased to 12 feet, and the width decreased to ten feet, near Appleton's shaft.

On the south, near Dodger's Flat, dry-blowing is still being carried on, the gold-bearing "wash" occurring on a false bottom, 18 inches from the surface.

Appleton's.—About half-way down the ridge. The shaft was sunk in the bottom of the surface lead, to a depth of 134 feet, the sinking consisting of bluish "cement" (conglomerate), red sandstone, fossiliferous shale, and fire-clay, in which several thin seams of coal are reported to have been cut; in fact, fragments of coal can be found on the tip. The schist bottom was not reached, owing to lack of funds.

11. VICTORIA LEAD.

This is supposed to be the northern continuation of Linklater's Lead, and was in full working during 1879. It was always reported to be very crooked and narrow. "The Victoria Lead at the summit of the hill . . . . was only 15 to 20 feet deep, ... but to the north, where it ran under the basalt, it was 100 feet deep. . . . Its average width is from 20 to 30 feet," and "the wash dirt is said to have averaged 1½ oz. to the load all the way through."*

The depth of "wash" taken, for an average yield of an ounce per load, was up to two feet.

Dr. Jack says:† "The Victoria Lead lies in a gutter, between the 'tish' on the east side and a slate bottom on the west. . . . On reaching the flat the lead turns to the north-north-west," and "from this point for 80 or 90 feet the lead contained very good gold." In 60 to 90 feet ground here Dr. Jack mentions that the wash yielded at the rate of 36 oz. to the load. In the Windlass shaft (130 feet south-south-east of the All Nations shaft) then open, he found the following section:—

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* G.S.Q.P., No. 27.

† G.S.Q.P., No. 103

Basalt	40 feet
Clay and sand	7 feet
Gravelly drift	100 feet.

Influx of water has always retarded the proving of this ground. The continuation of the lead is believed to be towards the north-north-west, from the All Nations.

All Nations.—The furthest out (most northerly) claim on the lead.

The claim was abandoned in July, because the prospects were too poor.

The shaft, 145 feet deep, bottomed on schist.

Gold-bearing "wash" has been reported at three different levels, which is interesting and important even though the ground in the upper levels is unpayable:—

(1) At the 100-feet level is a poor layer of wash.

(2) On the 125-feet level openings were made 6 feet to north and 6 feet to west, proving the "wash" to be auriferous, but not payable.

(3) At the 137-feet level is a 55-feet drive to the north on a channel 12 feet wide (18 inches wide in shaft). There is also a drive for 40 feet to the south, and one for over 100 feet to the west.

The "wash" (with blue clay, in which marcasite occurs) which has been hitherto taken as payably auriferous, was 12 inches thick. The gold in this level is coarse; in upper levels very light and spongy. It is reported to have averaged 1 oz. to the load, but in the face there is now only ½-oz. dirt showing, and that is considered to be too thin to be profitably treated here.

It is said that the gold with black seams always dips north-west, irrespective of the particular slope of the bottom, so that it reaches within ten feet of the surface at a point only 300 feet to south-east of this claim.

Beneath the "wash" is 9 feet of "tish."

12. DODGER'S FLAT.

This depression commences on the black soil downs, and extends south into Gowrie Creek. Its tributaries include the following:—

ST. PATRICK'S GULLY.

St. Patrick's Gully, rising on the Victoria Lead, runs east-south-eastwards. The gold, never abundant, was found in shallow "tish" ground.

Cousin's.—The shaft on the Flat, near the junction of the gully, proved ten feet black soil and ten feet brown conglomerate.

BULLOCKY GULLY.

Bullocky Gully is a short ravine on the eastern side of Dodger's Flat. There are numbers of shafts in it, the gold having been followed up to the base of the coal measures.

13. SMITH'S HILL.

This is the escarpment on the eastern side of Dodger's Flat. The whole hillside down to the flat has been worked over, like Cement Hill, below the basal conglomerate beds of the coal measures (sometimes called "tish"), which here are dipping south-easterly into the hill. Even now a few dry-blowers are at work on the hillside. Only one or two shafts have been sunk in the coal measures, and nothing is known about them.

The "wash" consists of rounded quartz, pilotstone, &c.

MORGAN'S GULLY.

A ravine on the southern side of Smith's Hill, which gave very good returns.

DUFFER GULLY.

Nearly half encircles Smith's Hill on the east. Deep shafts were sunk in the flat, but no gold was found.

14. LEONARD'S GULLY.

The gully, lying a mile east of the Springs Hotel, runs from north to south. The lead has been followed for ten chains diagonally up the slope to the north-east.

The "wash" appears to belong to the coal measures, here forming only a cap (15 feet thick near the hilltop, but much thicker in the gully).

Ringe's.—Halfway up the gully.

The shaft is 75 feet deep, the sinking being hard ferruginous "cement," with bands of fine-grained sandstone. It was not bottomed because of the large amount of water met with.

The dip is probably to the south-east or east, as the basal beds outcrop within ten yards to the north-west. In the shallower shafts in the vicinity gold was found in a surface "wash" with "billy" and basalt on a ferruginous "cement."

15. CHRISTMAS HILL.

Christmas Hill lies about a mile east-south-east of the Springs Hotel, and is a continuation of a broken ridge extending eastwards from Gowrie Creek. It rises about 50 feet above the black soil plain on the south.

The hill has been "surfaced" across from north-west to south-east, the bottom exposed being coal measures (ironstone). Most of this work was done thirty years ago, but still a little dry-blowing is attempted occasionally.

Otter's (abandoned).—On the south-eastern side of the hill.

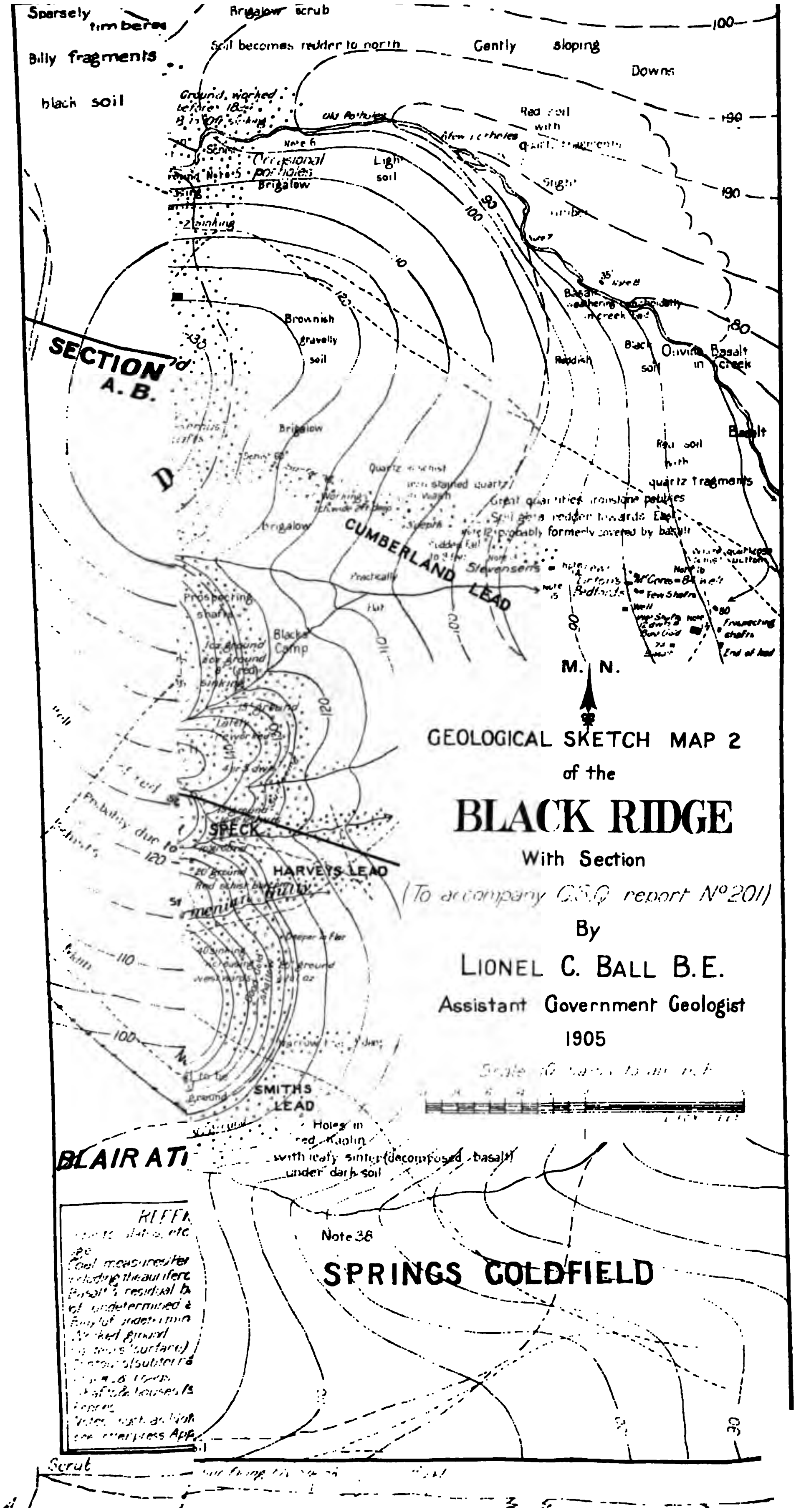
The shaft, 12 feet deep, was sunk in sandstone and conglomerate, overlying a bed of white shale containing fossil leaves (glossopteris, gangamopteris, &c.) Drives, formerly extended 15 feet to the east (now filled in) and 35 feet to the west-north-west, where a 17-feet shaft communicates with the surface. The ground east of this second shaft (similar in appearance to the ordinary Black Ridge red "cement") has been stoped out over an area 15 feet in diameter, in which the bottom slopes 1 in 12 to the south-west.

The bottom in some places is limonite, and in others a conglomerate of pebbles and shale, but it is nowhere schist.

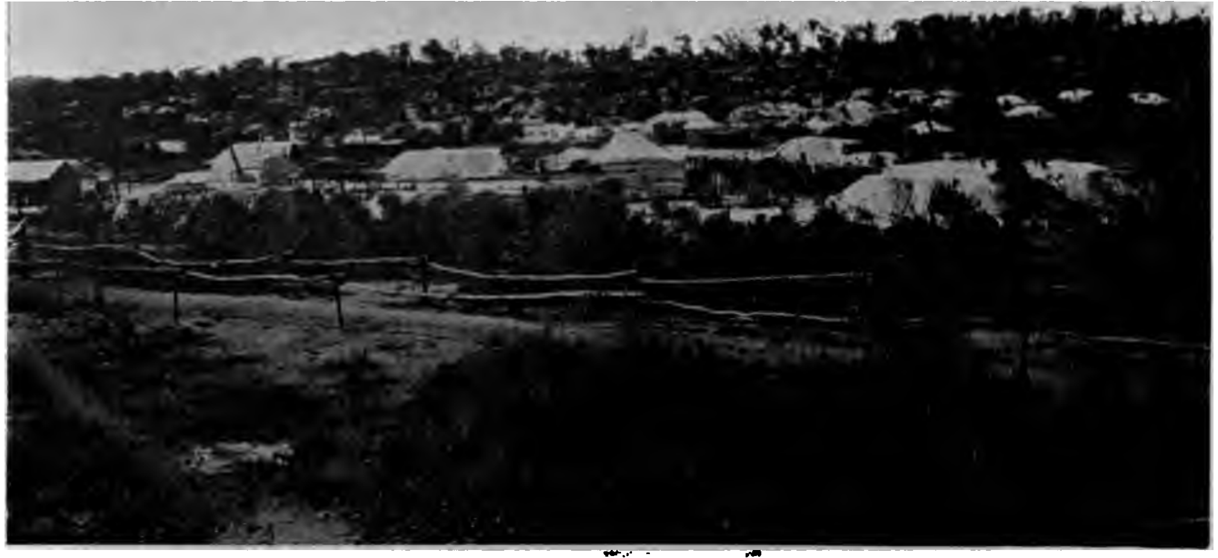
A third shaft, 37 feet deep, now inaccessible, lies 30 feet south of that last mentioned, the slope in it being 1 in 3 to the south-south-west. At the bottom of this shaft a 3-oz. "colour" is said to have been found.

A shaft, about a chain north-west of Otter's, is 25 feet deep; one, a chain to the south, is 60 or 70 feet deep; and another, 2½ chains to the north, is 60 feet deep. The last passed through white, red, and blue "wash," but it did not bottom, and no gold was found. These shafts prove that Otter's claim is on the "point" of a subterranean ridge and not in a trough or gutter.

The "wash" includes granite, schist, and quartz pebbles. All the gold from these workings was coarse.



GEOLOGICAL SKETCH MAP 2
of the
BLACK RIDGE
With Section
(To accompany G.S.Q. report Nº 201)
By
LIONEL C. BALL B.E.
Assistant Government Geologist
1905



SHALLOW GROUND EAST OF GOWRIE CREEK, BLACK RIDGE.

III.—BLACK RIDGE.

1. HISTORY.

The discovery of gold at the northern extremity of the Black Ridge, a low brigalow-covered escarpment on the eastern side of the head of Gowrie Creek, was announced by Messrs. Fox and Aplin in March, 1895; (though gold had been found and worked in Gowrie Creek on the north as early as 1892); and, the ground being shallow, the field was soon supporting a population of about a thousand men.

Fox's Lead (or Trail) was narrow and rich, and extended westwards a total distance of about ten chains, the depth increasing from 25 to 50 feet. From it the workings gradually extended southwards along the Ridge.

On the eastern side of the Ridge the ground was shallow, much of it surfacing for a distance of nearly a mile; but westwards the depth of the "wash" increased and the number of men on the field fell off; though, during 1899 and 1900, some success was achieved in opening up the Slaughter-yard, Daintree's Knob, and Hard Hill Leads. (Plate 5.) Nearly the whole of the ground on the Black Ridge, east of Gowrie Creek, has now been worked out, and the only hope for the future lies in the west.

The occurrence of a layer of "billy" along Gowrie Creek retarded prospecting to the west of Fox's Lead, but after the discovery of payable gold, in September, 1903, on the Old Cricket Ground, the whole flat west of the creek was pegged out, and at the time of my visit a line of claims connected these with the Deep Ground to the south-west.

Working westwards round the head of Gowrie Creek, in 1901, the blue ground was entered at a depth of 160 feet. This, poor at first, became richer as it was followed to the north-west, and proved payable at last in McGillivray's old claim (now Mason's). Though the fact that this ground was giving good returns seems to have been well known, no attempt was made to test that ahead for two years, when Bedford's shaft was sunk on the north. As colours only of gold were got in this, the miners seem to have given up all intention of further testing until, in the beginning of 1904, McGillivray, throwing up his old claim, took up another on the western side of it. This gave the necessary indication, and four other claims were taken up on the same line, with the result that gold was struck in all of them before the end of the year.

After the finding of payable gold by Madge (who held the outermost of the abovementioned four claims), the ground was pegged out on both sides of the line of deep shafts. When the writer left the field there were two shafts going down on the northern side, but, at the beginning of 1905, there were at least nine in process of sinking.

There is a small area between Daintree's Knob and the Deep Ground that gives promise, and will require prospecting; but the main extent of the ground is to the west and the north, in which directions no prospecting to speak of has been done.

2. SUMMARY.

(A) EXTENT PROVED AURIFEROUS.

The ground worked extends northwards for a little over a mile from the surfacing at the southern end of Hard Hill, and westwards for a little under a mile from the workings on Flyspeck Gully. There has hitherto been only one gap of any extent in this area (*i.e.*, between Daintree's Knob and the Deep Ground), but this is now being sunk on and may prove as rich as any of the portions yet tried.

(B) ORIGIN OF THE "WASH."

The "wash," as elsewhere indicated, is the lowermost portion of the basal conglomerate of the Bowen Coal Measures, which rest on a bedrock of schist sloping gently westwards; so that the workings, though at first comprising only "surfacing," are now nearly 250 feet deep.

It has not been proved that the conglomerates are in a "lead," in the sense of an old river channel, and the "wash" (or "cement" or conglomerate, however it may be termed) will in all probability be proved to mark the site of an estuary- or a lake-shore. If a sea-shore one would expect to find included marine shells; and, while their absence may be insufficient alone to disprove any seashore theory, the occurrence of an abundant land flora in the interbedded shales proves that they were laid down in fresh water.

It would be quite possible to have a river bed a mile wide (the proven width of the "wash" at the Ridge, though the conglomerate probably is still more extensive), but the beds have been so disturbed—raised in one part and lowered in another—that any form of channel, if such originally existed, can no longer be distinguished. If there were a river, its course must have been north-west and south-east (*i.e.*, on a line connecting the Springs and the Deep Ground). Beyond the Deep Ground, the channel should be expected to continue towards the Seventeen-mile Well, whence, after junctioning with the run from McMaster's, it would continue to the Miclere. There would be even a possibility of all three runs—Black Ridge, McMaster's, and Miclere—being tributary to one main channel beneath the basalt, the direction of which can as yet not be indicated.

If the conglomerate be a lacustrine or estuarine deposit, and if it be conceded that the gold has been introduced subsequently to its consolidation, it can be conceived that the solutions would tend to flow, to some extent, along the troughs in the bedrock, so giving the appearance of a lead, or a number of runs.

(c) NATURE OF AURIFEROUS "WASH."

Generally speaking, the "wash," to be favourable for gold, requires to be composed in greater part of sub-angular fragments of schist, with few or no quartz pebbles, though pilot stones may be abundant, while much sand is distinctly unfavourable. In the deeper ground the colour is usually bluish-green, this being due to salts of iron, as indicated by the colour at lesser depths changing to red. The iron stains have in most of the very shallow ground been almost completely leached out leaving the "wash" white.

The whole of the ground is not blocked out and broken down, but it is found that the gold occurs in runs (often locally called "leads") and patches, and some considerable areas have been left untouched, because believed to be barren or too poor to pay.

The most favourable bottom is one sloping westwards, with the laminæ of the bedrock dipping at a high angle in the same direction. Gold is especially abundant along the western sides of "bars," which in most cases appear to be due to faulting.

(D) ORIGIN OF THE GOLD.

The location and state of the gold, which will be referred to under the heading of "Present Conditions," leads one to the conclusion that it was not deposited at the time the "wash" was laid down, but since. Its occurrence on "false bottoms" and on rolls and sidlings, in preference to flats and gutters, is evidence against mechanical deposition, and the "paint" gold occurring so universally on the laminæ of the bedrock is strong evidence in favour of its deposition from solution. The frequent richness of the "wash" along falls and "bars" in the bottom (which have in most cases been produced by faulting), and the occurrence of gold so often above fissures and quartz lenses in the bedrock, both indicate precipitation from solution, these lines of weakness having presumably given passage to the auriferous solutions (or possibly to the preciptating agents).

In the description of Donaldson's claim it will be noticed that, in damp weather, a slight seepage, from the schists in the shaft bottom, is to be seen, proving that even now solutions are exuding from the bedrock, though the "wash" is practically dry. Patches of surfacing are occasionally met with in schist country (as at Black Johnson's and the Mystery), the gold in which it is difficult to account for, except on the hypothesis that it has been derived in solution from the rock beneath.

Bedrock would offer some check to the downward course of solutions circulating in the "wash," though other solutions under greater pressure might exude from the bedrock. The solutions would thus mix and react upon one another in the vicinity of the bottom of the "wash," and the precipitated gold would consequently be found there.

It seems likely that the auriferous solutions welled from the schists, and that the precipitating solutions circulated in the "wash," for the occurrence of gold in reefs and leaders in schists is common, while the presence of a precipitating agent in the schists is most uncommon. Sulphuretted hydrogen, however, was found in one quartz vein in schist in the Clermont district (*see* Callan's, in Appendix 2), but the example is the exception to the general rule.

As for the nature of the precipitant, one of the most common is carbonaceous matter, of which there may have been considerable quantities in the "wash" originally, though little is now to be found and that generally in intercalated shales. It is not likely to have ever been so widely distributed as the occurrence of the gold would necessitate. Another favourite precipitant is pyrite, but at the Black Ridge it has in almost all cases been found that, where pyrite (or marcasite) is most abundant, the "wash" is poorest in gold; and, further, a sample of pyrite from one of the claims on Gowrie Creek assayed for Mr. Dunstan contained only a few pennyweights per ton. The pyrite, or more probably marcasite, is found not alone filling cracks in quartz, but also coating pebbles themselves; besides which it must occur in considerable quantities in the "wash" in some parts, to judge by the rapid decomposition of the latter, with accompanying and consequent efflorescence of sulphates. It may, therefore, be taken as a secondary mineral in the "wash," deposited probably contemporaneously with the gold. The presence of this sulphide points to the former existence of an excess of sulphuretted hydrogen, a gas given off during volcanic eruptions. It is, therefore, possible that this gas might have found its way through the basal conglomerate from volcanic necks or fissures piercing the coal measures. Such necks or fissures, up which the basalts, now covering the coal measures in greater part, could find their way, there must of course have been.

It is believed that thus all the various conditions under which the gold is found here may be accounted for. It would not be necessary that either or both of the solutions should permeate the whole area of the wash at one time. The solutions may have been of limited volume, and that from the schist given off from limited areas, they would in that case tend to follow certain "runs," and so might never reach some parts of the "wash," which would, therefore, remain barren.

It has long been held by some writers that the gold in the "banket," on the South African Rand, was introduced subsequently to the consolidation of the conglomerates; and, though others deny the possibility, most of the evidence seems to be in its favour. The latest paper on the subject is that of Hatch and Corstorphine,* in which it is stated that the conglomerates consist chiefly of rolled fragments of quartz, and occasionally quartzite, banded chert, and slate, cemented by secondary quartz. Pyrite is common with a radiate and concentric structure, and small black spots of carbonaceous matter occur, the gold encrusting both minerals. The authors conclude that the gold was brought in by the same percolating waters that carried the cementing material of the conglomerate; and that it was precipitated possibly by the pyrite, and in places by the carbonaceous matter. Their reasons for believing in the infiltration theory are:—"(1) The gold is practically confined to the matrix of the conglomerate, and occurs there in association with other minerals of secondary origin. The few rare cases in which we have seen gold in the pebbles were obviously instances of infiltration along cracks—a fact which in itself tends to support the theory. (2) The gold occurs in crystalline particles, often surrounded or lying in close association with pyrites, crystals or concretions, which are of secondary origin. (3) The almost uniform fineness of the distribution of the gold. (4) The restriction of the gold to certain definite beds."

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* Petrography of the Witwatersrand Conglomerates. By Frederick H. Hatch and Geo. S. Corstorphine. Trans. Geol. Soc., S. Africa. Reviewed in "Mining Magazine," Apr., 1905.

There is thus a strong similarity between the Black Ridge and the Witwatersrand, and the future for the former is thereby rendered all the brighter.

3. FUTURE PROSPECTS.

(A) PROBABLE DIRECTION AND DEPTH OF CONTINUATION OF AURIFEROUS GROUND.

The wash at Cement Hill (Springs) and that at the Black Ridge were, in my opinion, formerly continuous. If the "wash" be in a channel, the probable continuation would be to the north-west (though it is of course impossible to say definitely without data what way a stream may turn). Similarly if the "wash" be a shore deposit the evidence seems to show that the continuance of the auriferous ground will be to the north-westwards, even though, just at present (April), it seems to be opening out to the north.

As to the depth of the ground to the north-west, the slope hitherto has been up to 1 in 12, but that has really been on a side channel, and in any case the strata should be expected to rapidly flatten out northwards, as at the Miclere the slope is towards the Ridge. Taking the dip as 1 in 20, the "wash" should lie at a depth of 500 feet at a distance one mile north-west of Heuat's claim (on the Deep Ground).

The main obstacle to the future working of the deep ground will be the zone of water-logged strata beneath the basalt. Already the miners are asking for Government assistance for pumping, but as yet they have not found it impossible to keep back the water. The pressure of the water will increase with the depth of the base of the basalt, and it may prove beyond the individual miner's means to keep it back.

To give an idea of the conditions it may be mentioned that—

Neight has reported raising 1,300 gallons (= say, 6 tons) of water per hour; and

Wyles has reported raising 800 gallons (= say, 3½ tons) of water per hour.

It will, however, always be possible to sink through it, if necessary, by the adoption of some system, such as the Kind-Chaurdon.

(B) Prospecting by Shaft and Drill.

Prospecting by shaft is not likely to be ever undertaken many chains beyond proved auriferous ground, for, though in case of success the shaft may be used for the exploitation of the "wash," failure, which in the majority of cases is to be expected, would mean a greater loss. It would often be necessary to sink a line of shafts or bores, and then everything is in favour of boring.

The cost of shaft sinking would amount to at least 30s. per foot down to 250 feet, and 40s. down to 500 feet depth. Any increased thickness of undecomposed basalt would, of course, amplify these figures, and the striking of a large supply of water beneath the basalt might run them up indefinitely. The last item, the amount of water struck in sinking, would cause no variation in the cost of drilling, which might be put at from 10s. to 20s. per foot. Either jumper-, diamond-, or calyx-drill should prove successful, but the calyx should be specially adapted to the comparatively soft rocks of the Ridge.

4. PRESENT CONDITIONS.

The work done hitherto may, for purposes of description, be divided into surfacing, shallow sinking, and deep sinking, the last two being somewhat arbitrary divisions, as explained below.

(A) Surfacing.

"Surfacing" consists in laying bare the bed-rock by removing the whole of the soil and subsoil. The gold contents have in all cases in the vicinity of the Ridge been derived from an outcrop of "wash" higher up the hillside, and formerly extending outwards over what are now depressions. In some other localities the gold is residual from the degradation of schists veined with auriferous quartz leaders. There is strong presumptive evidence that solution of part of the gold has taken place, in that these residual deposits at the Ridge were no richer—in fact, were often poorer—than the beds from which they were derived.

In this district the poorest material is dry-jigged, and while the richer is dry-blown (Plate 6), the very rich has been carted to the puddlers for treatment. The best returns seem to have been between ½ and 1 oz. to the load.

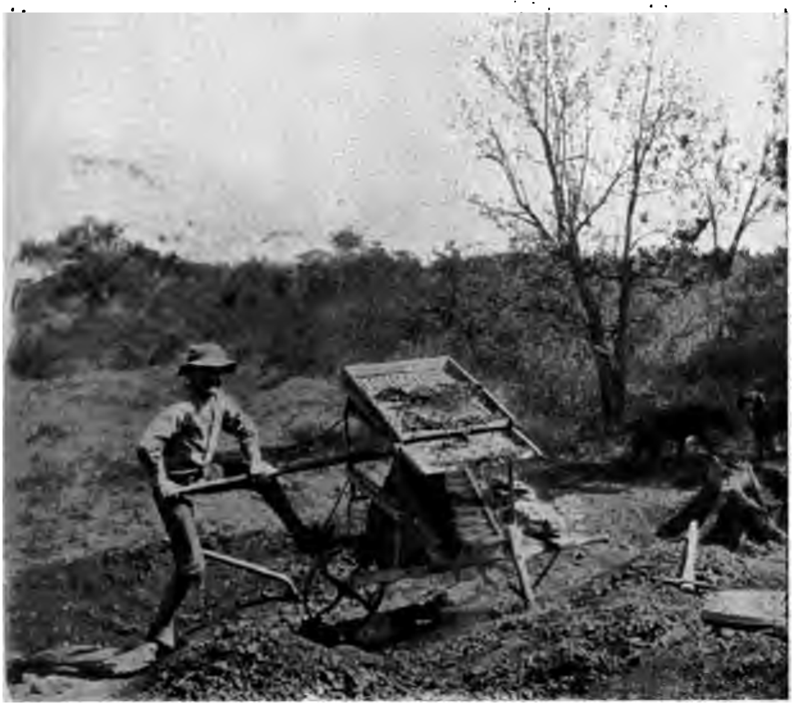

Photo., L.C.B.

Plate 6.

DRY-BLOWING ON LIMESTONE HILL.

SHOWING THICKNESS OF SOIL TREATED.

Surfacing began, as explained, at Gowrie Creek, at the northern end of the Black Ridge, and continued southwards past Cumberland's Lead (where much of the work is really only surfacing or "gully raking"), through Flyspeck and Armenian's Gully to Smith's Workings and the Hard Hill Lead, beyond which the ground became too poor to work. The best gold along the outcrop appears to have been in residual soil 10 or 12 feet deep.

At the time of my visit no "surfacing" was going on beyond that done by one or two dry-jiggers and dry-blowers working out the few small patches left at the time of the rush. The earnings of these men were exceedingly small.

(B) SHALLOW SINKING.*

By sinking is meant the opening of shafts and working out the auriferous "wash" without removing the overburden, and the working miner considers depths of from 6 to 20—and even 50—feet quite ordinary ground; but it requires a certain amount of courage to sink from 50 to 100 feet, while beyond that financial considerations have weight as well. Under the heading of shallow sinking will be described all the working mines to the east of McGillivray's old claim.

Generally the "wash" increased in depth westwards of the surfacing (*i.e.*, the outcrop), on the eastern side of the Black Ridge, and this in spite of the strata dipping beneath the Gowrie Creek depression. Some of the best yields (from 30 dwt. to 4 oz. to the load†) were obtained southwards along the side of the ridge near the outcrop of the conglomerate.

In the middle of 1904, almost all the claims on the western side of the original Black Ridge, and east of Gowrie Creek, either had been or were being abandoned, or were giving signs of rapid exhaustion; and, owing to this fact, the number of unemployed was becoming very perceptible. This, the eastern, part of the ground was characterised by the number of trails with a westerly course.

(*a*) FOX'S LEAD.

Fox's (or Alpin's) Lead (or Trail) is at the northern end of the Ridge, and on it the original P.C. of the Black Ridge was located.

In Fox's Lead the sinking quickly deepened westwards of the P.C. from 6 feet to 40 feet, and even 50 feet, the yield being from four to five ounces to the load.

On the western side of Gowrie Creek the width of the trail was 15 to 18 feet.

Horwood's.—In the vicinity of the original prospecting claim.

This is one of the few claims on unworked blocks, and in it the "wash" is at a depth of 38 feet.

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* In the descriptions of the claims an attempt will be made to give in order the location, depth and extent of workings, nature of "wash," thickness of "wash" taken and yield of same, slope and character of bottom, bedrock, and any other particulars.

† A load of "wash" is generally computed by the miners to weigh $1\frac{1}{4}$ tons.

(*b*) TURKEY'S NEST.

This was 50-feet ground lying to the south of Fox's Lead, on Gowrie Creek. The claims here are said to have averaged 25 dwt. to the load.

(*c*) CUMBERLAND LEAD.

This narrow trail, generally only a few feet wide, extended from the surface workings on the eastern side of the Black Ridge for nearly ½-mile to the east, the depth gradually increasing to over 80 feet.

Much of the "wash" was dry-blown, and there were, at the time of my visit, one or two men treating the surface soil in the upper part of the lead.

The occurrence of pipeclay, up to 40 feet in thickness, in the eastern portion, is probably due to the decomposition, *in situ*, of basalt.

Linton's.—Situated at the lower end of the lead.

The shaft is 60 feet deep, and bottomed on the side of a pothole or (as it seemed to me) a trough, running north-north-west. A chamber 10 feet in diameter has been opened west of the shaft, and from it a drive continues 10 feet further west along a narrow trail of gold.

The "wash" in the pothole is free puddling, consisting of clay (decomposed slate?) with distributed angular fragments and rounded pebbles and boulders of quartz. The rounded pebbles and boulders have probably sunk from above into the "wash," while the angular fragments were derived from veins in the schist. The thickness of auriferous "wash" is six feet.

The "prospects" range from five pennyweights to two ounces to the load, extraordinary yields (one ounce of coarse gold to the dish) having been obtained in the gutter running west from the pothole, where the gold seemed to be as much in the decomposed clay slate bottom as in the "wash." This trail was lost at about 20 feet from the shaft, and seems to have passed overhead.

The "free wash" overlies auriferous "cement," which requires crushing, and of which most is, therefore, at present left in place. A face of 10 feet of "wash" and "cement" has been exposed in one place, and the returns for the stone broken down and raised from there are:—

8 loads	puddled for	... ... 16 dwt.	per load.
9 loads	,,	... ... 8 dwt.	,,
12 loads	,,	34 oz., total = 2 oz. 16 dwt. 16 gr.	,,
12 loads	,,	37 oz., total = 3 oz. 1 dwt. 16 gr.	,,
12 loads	,,	32 oz., total = 2 oz. 13 dwt. 8 gr.	,,
20 loads	,,	... ... 1 oz. up to 3 oz.	,,

The slate side or bottom, east and west of the trough, is probably due to faulting (a throw of seven feet or more), and to that cause the origin of the gold may be due.

The bed-rock is brown sandy micaceous clay-schist.

The claims east of Linton's secured one or two puddlers (20 or 30 tons), but were flooded out early in 1904.

Bedford's.—Adjoins Linton's claim in the south.

It is reported that no "free wash" was found, and that an influx of water from the cement prevented continuation of work.

McGore's.—Four chains east of Linton's.

The shaft, now used as a well, is 84 feet deep.

Colours only of gold were found in the wash, but it is understood that very little driving was done to prove the ground.

(*d*) FLYSPECK.

Flyspeck is one of the ravines on the eastern side of the Ridge.

A considerable amount of work has been done in its vicinity, but, in July, 1904, only one claim was held, and that was in 40-feet ground. The "wash" is "free puddling," and 9 or 10 inches are broken down, the average yield being only about five pennyweights per load.

(*e*) SMITH'S WORKINGS.

A small patch of ground on the point of the ridge, ¼ mile south of Flyspeck.

The "wash" includes much ferruginous quartz. Only a few loads were obtained, for a yield of eight pennyweights per load.

(*f*) WHITE GROUND.

The white ground covers an area of 40 acres near Fox's Lead, on the western slopes at the northern end of the Black Ridge.

The depth of the ground increased rapidly from 10 to 30 feet southwards and westwards.

An area, 10 feet to 14 feet deep, near the point of the Ridge, yielded five pennyweights to the bag, the "wash" having to be carried to the Springs for treatment.

It is recorded that where patches of pink "wash" occurred in the White Ground it was always poor—containing only four or five pennyweights to the load.

(*g*) YELLOW GROUND.

This, richer as a rule than the White, formed an adjoining north-west and south-east belt, covering an area of 10 acres.

In one of the claims on the Yellow Ground, with 40-feet sinking, the gold is reported to have been found both on the true (schist) bottom, and on a false (grit) bottom 15 feet above the schist.

(*h*) RED GROUND (Slaughter Yard Lead).

The Red Ground, 50 acres in area, had, like the Yellow and White, numbers of trails running a little north of west, which were here unusually wide in places. In about the centre of the "Lead" (as the area is called) gold was found in the "headings" five or six feet above the bottom, enabling a second party to work the abandoned ground.

The bed-rock is red schist.

This ground was worked during 1899.

(*i*) UNWORKED GROUND.

The belt (area 15 acres) lies in the "Slaughter Yard Lead," and extends from the Ridge top to the billiard-room west of Gowrie Creek.

The "wash" in this area is believed to lie at from 60 to 80 feet beneath the surface. It is practically untried, either because the yield in the shallow ground (the outcrop) was poor, or because of a supposed rise in the bottom here, or, more likely, because the ground is known to be hard and the trails narrow (two or three feet in width).

(*j*) DAINTREE'S KNOB.

The Knob, an outcrop of "billy," at the head of Gowrie Creek, is said to have been named after the then Government Geologist, who visited the locality some thirty years ago.

East of the Knob the auriferous patches were disconnected, and while on the west there were runs, they were in the end lost; it is expected, however, that they will be picked up again still further west or to the north-west.

Mr. Dunstan records that in the shafts here 16 feet to 26 feet of "billy" was pierced. I could obtain no reliable evidence of gold occurring in the "billy," though it had previously been affirmed that a seven-grain speck had been found. It is further recorded that "sometimes the whole of the material of the 'wash' is cemented together with secondary iron pyrite, masses of which are met with in some of the workings," and that the gold present in the "wash" is distinct from that in the mundic. Unfortunately none of the mines were being worked in this pyritous "wash" at the time of my visit, and on the "mullock" heaps the mineral had decomposed. The "mullock" on some of the heaps at Daintree's Knob certainly showed strong indications of having contained much pyrite (or marcasite).

It is understood that the ground, from the head of the lead for ¼ mile to the north, gave an average yield of seven or eight pennyweights per load puddled. (Plate 7.) The greater part of the work in this locality was done during 1901.

Grant's.—East of Daintree's Knob.

This claim has been in operation under different parties for over twelve months. Two men are now producing, by pick and gad work, twelve loads of "dirt" per month.

The main shaft bottomed on "wash" at a depth of 103 feet, and from it all work has been towards the north and east.

The "wash" contains numerous pebbles of decomposed granite, together with schist and quartzite. The majority of the pebbles dip to the south-south-west, at an angle of 30°, and it has been assumed, in consequence, that the stream came from the north-north-east. There is no defined "lead" here, the gold occurring in patches, sometimes 20 feet across, and often disappearing quite suddenly. The boundary between the auriferous and barren ground is, however, indistinguish-

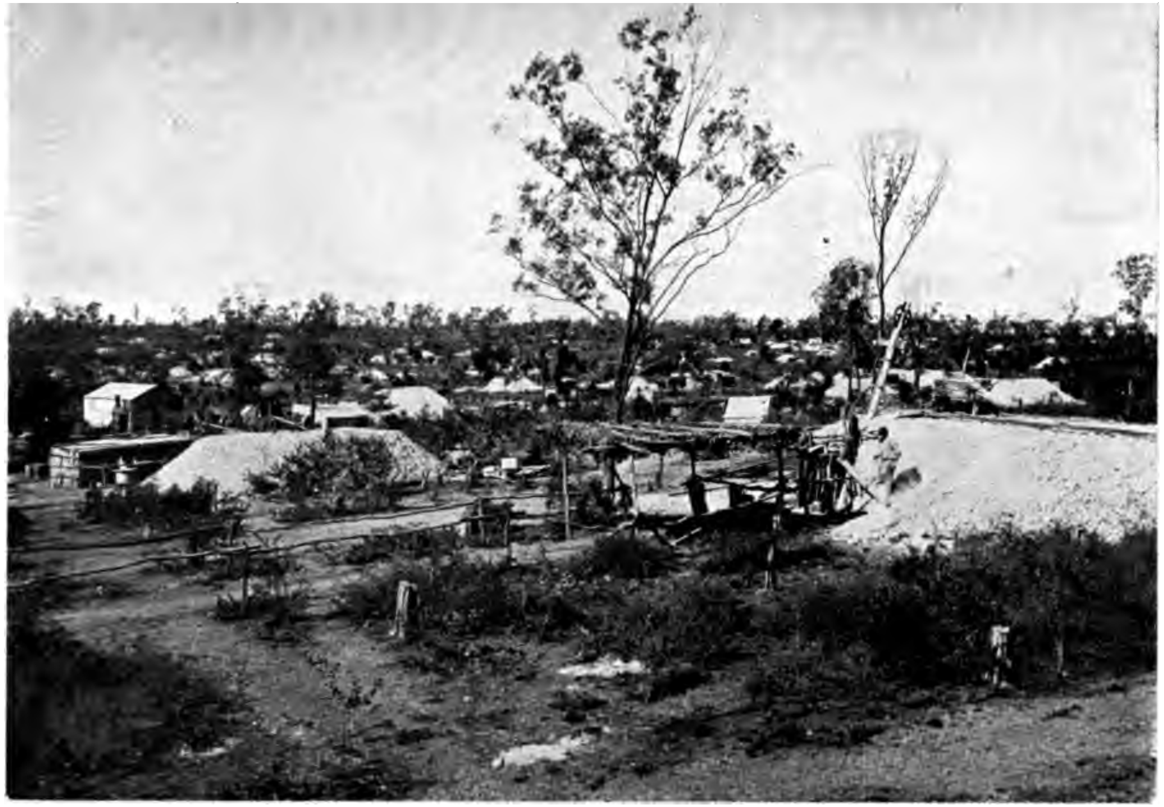

Photo., L.C.B.

SHALLOW GROUND AT HEAD OF GOWRIE CREEK, BLACK RIDGE.

Plate 7

able, and the amount to be saved has to be determined by constant prospecting with the dish. The gold is mostly within 6 to 18 inches of bedrock, though, in some parts up to six or seven pennyweights per load is found from three to six feet above bottom. It is generally absent where the floor is flat.

Some of the gold is found embedded in the bedrock, of which it is therefore necessary to tear up three inches for treatment with the lower six inches (to 18 inches) of "wash." The average yield is 10 dwt. per load.

The bottom rolls to a considerable extent.

The bedrock is schist, the foliæ of which are generally parallel to the old land surface, though at times they are steeply inclined to it. When the foliæ dip in the same direction as the surface of the bottom they form riffles, sometimes six inches high, which have been instrumental in catching the gold, but, when the foliae dip in the opposite direction, riffles are not produced, and the ground is consequently poor.

Dequin's.—West of Daintree's Knob.

This has been one of the most constantly, as well as most profitably, worked claims on the field.

The whip shaft is 116 feet deep, and the windlass shaft (100 feet to the north-east) is 110 feet deep. The shafts are now connected by drives. On both sides of the drive running west from the whip shaft, and round that shaft itself a large area of ground has been worked out.

The depth of the "wash" below the surface is about 110 feet—varying between 100 feet and 120 feet.

The "wash" contains, besides schist, &c., much granite; and, it is noticeable that the change from blue to red (oxidised) "cement" occurs where there is also a distinct change of colour in the bed-rock. Blue fossilferous shale occurs above the "wash" in one place west of the windlass shaft. The miners have found the gold to be most plentiful on top of a "slate bar" (*i.e.*, a ridge in the bottom, produced probably by faulting); and they have also noticed that it lies mostly along brown streaks (fissures?) running west 10° south, through both the "cement" and the schist bottom. The run of gold on the north side of the bar was 40 feet wide. The blue ground south of the "bar" (exposed in the drive to the whip shaft) has been proved to contain only five pennyweights gold to the load, the payable ground lying north of the "bar."

The stone for treatment includes nine inches of "wash" and three inches of bedrock, and the ground worked is said to have averaged 30 dwt. per ton, while it has yielded as high as five and six ounces per ton.

The surface of the bottom is very irregular, but the general fall is to the south-west, as proved by the depths of the shafts.

The schist forming the bedrock is seamed by great numbers of quartz leaders, and it is said that granite dykes have also been seen in it (though this is doubtful).

At the bottom of the windlass shaft is a "mud bar," which may be crushed country on an incipient fault, but sufficient was not exposed for this point to be settled beyond doubt. Spheres of "mundic" (which, owing to their rapid decomposition, are most likely marcasite) are stated to have been found embedded in the "mud."

Carroll's.—Adjoins Dequin's on the north. It is said to have been one of the richest claims. Lately it had been intended to abandon the ground, but the opportune discovery of a new trail of gold, 80 feet east of the shaft, gave hope of continued life.

The shaft is 110 feet deep. East, north, and west of the shaft there is much worked-out ground, that open to view extending 100 feet east, 30 feet north, and 30 feet south of the shaft. It is in the southern face that the last work was done, along a rise in the bottom.

The workings here also are on the northern side of a "bar," believed to be the same as that in Dequin's.

The "wash" in parts (as south of the shaft) is very coarse, and consists in great part of rounded schist, though waterworn boulders of other rocks also occur. Lenticular seams of pyritous shale, dipping with the bottom, were seen in the wash. Both red and blue "wash" occur, and in the eastern face it has been proved that there is no gold in the red "cement" on the bottom, though the overlying blue stone is payably auriferous, the assumption being that the gold has been leached out of the former. All the gold in this claim is coated, two pennyweight "specks" even being indistinguishable in the "wash." The gold is worth £4 1s. 8d. an oz. when cleaned.

For treatment, four inches of bedrock and up to two feet of "wash" are raised. The eastern workings are reported to have yielded from 15 dwt. to two ounces to the load, but the "wash" in the face there contains only eight pennyweights. During the last year the average yield has been over 15 dwt. per load, the June (?), 1904, crushing being for 16¾ dwt. In August, 1904,—

40 tons were crushed for eight pennyweights per ton,

but it was generally admitted that gold was lost by the battery, in this case. The total output for 1904 is, according to the Warden—

50 tons, yielding 29 oz. = 11 dwt. 14 gr. per ton.

The "schist" bottom slopes at an average angle of 1 in 12 to the west, but there are many variations.

Wainsboro's (abandoned).—Near Carroll's.

There are reported to have been several crushings for five ounces to the load.

Davis's (abandoned).—East of Dequin's.

The main shaft sinking included a considerable thickness of dark carbonaceous and pyritous shale (with fragments of charcoal and stems of plants) just above the wash. The same shale in a claim to the east is said to have been very coaly.

In this shaft there is said to have been two or three feet of "wash," containing large amounts of "pilot stone," and carrying 15 to 17 dwt. of gold per load.

The northern shaft is 115 feet deep.

It is reported that 500 loads were raised, for a yield of one ounce per load.

Potts's.—South of Daintree's Knob.

The shaft is about 100 feet deep, and although on the edge of the Knob, only one boulder of "billy" was found near the surface in sinking. Mr. Potts told me of a thin seam of impure coal which (if not cut in this shaft) he knew to be two feet six inches above the "wash" in one of the abandoned claims in the blue ground to the north-west. The ground worked, chiefly east of the shaft, is 35 feet in diameter.

The "wash" is partly cemented, and all has to be "shot" down. Gold, much of which is fine, is now being got 20 feet north-west of the shaft, on a saddle. There being no gold in the adjacent gutter indicates that it was brought into the "wash" in solution.

The first party working this claim took about a foot of "wash" for an average of 9 or 10 dwt., but the present holder proposes to break down 15 inches, and he hopes to average nearly an ounce to the ton, the pannings-off having shown between three and four grains to the dish.

The general slope of the bottom may be taken as west and south-west.

The bedrock is foliated schist. The foliæ lie practically flat, and are traversed by numerous quartz lenses and iron-stained cracks, up which solutions may have come.

Fitz and Gore's (abandoned).—About five chains south of Dequin's, and the same distance west of Potts's.

The shaft is 105 feet deep.

This was one of the richest of the earlier claims, the yield having been three ounces per load for over a year.

(*k*) HARD HILL LEAD.

The lead takes its name from the "tightness" of the "wash," which, together with the patchiness of the gold and the smallness of the numerous trails, rendered it anything but favourable ground to work. There are many blocks still left. The run continues, as mentioned elsewhere, past Daintree's Knob, and it will, it is confidently expected, be followed out into the Deep Ground to the west or north-west.

There was only one claim at work on **Hard Hill** at the time of my visit, most of the work having been done during the year 1900.

P.C. (abandoned).—Wells and Joyce here had a small patch which was not traceable into adjoining claims.

Ferguson's.—The claim lies in about the centre of the lead, and has been worked for the last year.

The shaft is 60 feet deep. In the south-western extremity of the workings two gutters, with a westerly run and dip, are being followed, the gold, elsewhere distributed, having apparently been concentrated in them.

The "wash" consists of well waterworn pebbles of slate, and above it is a blue, red, and brown fine-grained sediment. The two feet resting on bottom is a hard cemented ferruginous conglomerate.

As a rule, nine inches of "cement" is taken for crushing, together with three or four inches of bedrock. About 120 tons have, during the last fifteen months, been crushed, for an average yield of 15 dwt. (from 8 dwt. to 30 dwt.) to the ton.

The bottom slopes from 1 in 10 to 1 in 5 towards the south-west.

The bedrock is a light chloritic schist.

(*l*) BLUE GROUND.

All the old claims on the Blue Ground west of Gowrie Creek and north of Daintree's Knob have been deserted. The yields seem to have been below the normal. East of the creek a party (Meyer's) had just bottomed a "duffer." They struck "wash" at a depth of 104 feet, but it was barren.

(*m*) OLD CRICKET GROUND.

This ground, on the western side of Gowrie Creek and to the south-west of Fox's Run, long lay neglected because of the suspected existence in the sinking of a thick bed of "billy," one of the hardest rocks known in mining. The "billy," having been proved to lie off the Old Cricket Ground (to the east), shaft sinking was at once begun, with the results given below. (Plate 8.)

The claims, with the exception of one or two of the earlier ones which proved "duffers," were all in full working order when visited, and offered every facility for an inspection.

The gold from here is rounded when coarse, but when fine it is flaky and generally concave.

Hopkin's.—This claim, lying beside Gowric Creek, was one of the earliest in the vicinity. It proved a "duffer," but the strata cut in it are here quoted as showing what was expected on the Old Cricket Ground:—

Surface red clay	1 foot 6 inches
Weathered basalt	20 feet
Sand	1 foot
"Billy" (solid)	25 feet
"Billy" (pudding stone)..	10 feet
"Headings" (conglomerate)	6 feet 6 inches
	64 feet

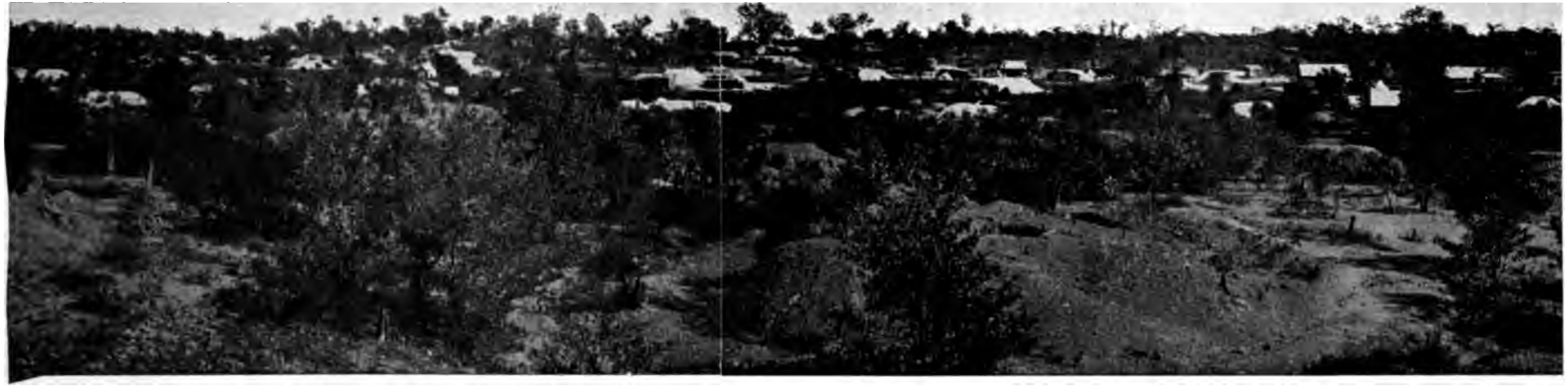

Photo., *L.C.B.*

BLACK RIDGE WORKINGS.

Plate 8.

PANORAMA—LOOKING TOWARDS DEEP GROUND ACROSS GOWRIE CREEK.

Soft white decomposed schist bottom.

Yates.—This is the windlass well situated in front of Noonan's store.

The shaft, 69 feet deep, was sunk about five years ago, through basalt (20 feet), "billy," and sand, overlying barren "cement." The sinking took six months. Fitz and party, in 1903, opened out chambers on each side of the shaft, within 10 feet of which a "fall" (fault ?) of nine feet occurs.

Gold was found on a sidling and channel (fault ?), passing three feet from the shaft.

The "wash" at 70 feet west of the shaft contained only four pennyweights to the load. Fitz raised from the chambers, it is said, about fifty-eight loads:—

44 loads yielded	28 dwt. per load.
1 load yielded	13 dwt. per load.
13 loads (the last) yielded	4¾ dwt. per load.

Dixon's (Fraser and Lock).—West of Noonan's store. After having been abandoned, the claim, at the time of my visit (in August, 1904), had been just taken up again.

The shaft is 118 feet deep ("wash" having been cut at a depth of 115 feet). It had lately been bailed and cleaned out, and an attempt was being made by driving to the south-east to cut the old run of gold (worked in a large chamber 25 feet south of the shaft).

In the "wash" in the drive, at 30 feet from the shaft, there is, with a fair amount of quartz, a large proportion of sand, which is considered an unfavourable constituent by the miners.

When first worked, it is understood, ½-dwt. to the dish (2½ oz. to the ton) was obtained south of the shaft.

The bottom is slickensided, and slopes 1 in 1 south-west (in the drive).

The bedrock consists of thinly laminated blue and white chloritic and sandy schists, dipping steeply to the south-west, and containing numerous quartz leaders. Such would be generally considered promising for the occurrence of gold.

Dan Carroll's.—On the northern part of the Old Cricket Ground.

The present working shaft, the second sunk, is 73 feet deep. It is understood that the sinking included—basalt, 20 feet; "billy," 1 foot; and "billy" sand, 12 feet. Chambers have been excavated east and west of the shaft, and a drive has been carried out about 100 feet along the old workings to the south-west, where is the present face. The workings east of the shaft are inaccessible.

There is very little quartz and there are few "pilot stones" in the "wash," which consists practically of schist, often in very large boulders set in clay, and such is generally believed locally to be very favourable ground for the occurrence of gold. Many of the fragments dip to the north-west, but the rule is not universal, even in this claim.

The gold may sometimes in sidlings occur 18 inches above bedrock; and, as it is impracticable to test the whole face as broken down, it is often necessary to risk sending 20 tons to the puddler without knowing for certain whether the contents are payable or not. Prospecting the "wash" here is unsatisfactory, for the additional reason that the gold is "shotty," colours up to 23 dwt. having been found.

About a foot of "wash" and three inches of bedrock are sent to the puddler—the average yield being only five or six pennyweights per load, while the best was 13 dwt. Such a small yield pays, because of the softness of both "wash" and bedrock.

The bottom here is, as a rule, nearly level. The slope of 1 in 5 to the south-west at the present face is believed to be merely the side of a local hollow, for the general slope, as proved by the adjoining claims, is to the west.

The bedrock is soft schist, the vertical laminations of which strike north-east. Owing to its extreme softness, the pebbles of the "wash" have in places sunk several inches into it, and it is, therefore, sometimes difficult to say where the original bottom really is.

Hill's.—Adjoins Carroll's on the south.

From the main shaft the workings extend 55 feet north and south. The present face is about 60 feet south-west of the shaft, and adjoins Cockson's boundary.

The "wash" is composed chiefly of rounded schist pebbles, with numerous "pilots," but very little quartz, and the boulders in the present face are mostly inclined to the south-west. It is richest where "puggy," being poor, as a rule, when sandy or gravelly (as to the south-west of the shaft). Though only the lowest foot or so is auriferous, the conglomerate extends up the shaft for 25 feet. In the northern workings the best gold (¼-dwt. to the dish) was found in "puggy wash" on the western side of a "bar" (the slope of which was 45°); while in the southern workings the richest (three pennyweights to the dish) was found on top of the "bar," and consisted mostly of "specimens" (*i.e.*, gold attached to the original quartz). Unfortunately, I could see none of this "specimen" gold.

The material for treatment consists of nine inches "wash" and four inches bedrock. The output previous to August, 1904, given me by the claim-holders, includes:—

18 loads (of 1¼ tons), yielding	5 dwt. per load.
24 loads, yielding	19 dwt. per load.
19 loads, yielding	19 dwt. per load.
19 loads, yielding	9 dwt. per load.

The last was the total output for 1904, according to the Warden's annual report.

The general slope of the bottom (from 1 in 1 to 1 in 20) is westerly, but there are very numerous rolls, the influence of which is shown by the "wash" being generally poor when the fall is towards the north or east.

The bedrock is foliated schist (on edge), in which occur hungry quartz leaders, often reaching to the "wash," in which in their vicinity there is usually rich gold. The partings in the schist have in many cases distinctly the appearance of fissures, which, however, do not continue into the "wash," at least not more than ¼-inch, for the pebbles have never been affected in the least.

Cockson's.—Adjoins Hill's claim on the south.

The whip shaft is 103 feet deep, and the workings, about 30 feet in diameter, have opened out on the west to Donaldson's and Williamson's boundaries.

The "wash" comprises chiefly medium-sized (two inches to three inches diameter) flat pebbles of decomposed schist, with comparatively few quartz pebbles.

A specimen of the "wash," consisting of waterworn pebbles of schist, with much marcasite in the cementing material, was secured in this claim. Eight months after obtaining it, the marcasite was found to have almost completely decomposed, and not alone had the pebbles fallen apart, but they had become cracked throughout, and covered with a feathery growth of epsomite where had formerly been marcasite. The best gold is discovered on sidlings, and generally more abundantly where the bottom is tinted blue.

On an average six inches "wash" and four inches of bedrock are raised for treatment.

Between the "wash" and bottom is a thin seam of dark "pug," or flucan, which is a strong indication of there having been a movement of the coal measures on the schists. The slope of the bottom is from 1 in 8 to 1 in 12 to the west.

The soft schist (bedrock) is on edge and the laminæ strike north-east.

George's.—East of Cockson's and south of Carroll's claim.

The only shaft on the claim is 75 feet deep, bedrock being struck at a depth of 70 feet, as shown in the following section (for which I am indebted to the claim-holders):—

Soil	2 feet
Decomposed basalt	33 feet
"Billy"	4 feet
Hard "cement"	4 feet
"Pug" conglomerate	27 feet
Schist	5 feet

A considerable area of comparatively poor ground has been worked out along a north and south "bar," south and east of the shaft. At present work is going on about 60 feet north of the shaft.

The "wash" consists entirely of decomposed schist, in a very soft state, and, therefore, suitable for puddling; but, owing to the prevalence of "soapy heads," large masses are liable at any time to fall away from the roof of the workings. The gold is, except on the northern boundary, all fine and flaky, the biggest speck weighing two pennyweights six grains.

The average yield has been seven pennyweights (the best was 9½ dwt.) per load, the total amount of material treated being about 120 loads. During the three months—June, July, August, 1904—there were puddled—

43 loads for a yield of 30 oz., equal to 13 dwt. 23 gr. per load.

The bottom south of the shaft is flat, but north of it the slope is to the west and south.

The bedrock, which, like the "wash," is very soft, is schist, with quartz leaders striking east-north-east.

Reedy's and Williamson's.—South of Cockson's claim.

The main shaft, in the north-western corner of the claim, is 102 feet deep; in the upper part 30 feet of basalt overlying four feet of "billy sand" was pierced. In August, 1904, about one-third of the ground had been cut out.

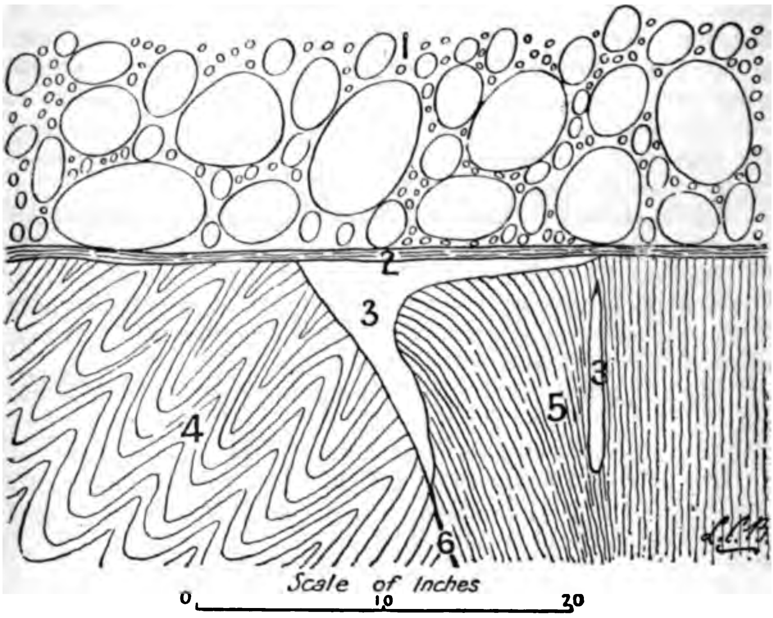

FIG. 1.—LEADER ON FAULT, REEDY'S CLAIM, BLACK RIDGE.

1. "Wash."	*4. Contorted schist.*
2. "Pug" seam.	*5. Foliated schist.*
3. Quartz.	*6. Fault.*

"Mundic" ocurs in the "wash," but it does not seem to have had any beneficial effect on the gold contents, assays made early in 1904 of some of the mineral showing only a few pennyweights per ton. The gold is "shotty," the coarsest slug found weighing one ounce, and being rounded. It is believed to be practically all within six inches of the bottom.

The gold is secured by the removal of six inches of "wash" and three inches of bedrock. During the last twelve months about 300 loads have been raised and treated, for an average yield of one ounce to the load; but one puddler (20 tons) is said to have carried 2½ oz. per load.

The slope of the bottom is about 1 in 15 to the west, throughout the workings.

The bedrock is schist (on edge and slightly foliated), which on exposure to the air swells up (six inches in a night, it is said), becomes contorted, and breaks away. It is thus sometimes difficult to keep the drives open, and two feet six inch props are often embedded to a depth of 18 inches. It has been noticed that flat leaders, connecting with vertical stringers, occur in the schist, beneath the "wash," and above them the gold is always extra plentiful. The only occurrence seen is that given in Fig. 1. The fissure shown is evidently older than the "wash," as is also the quartz, but, this being a line of weakness, the auriferous solutions or the precipitating agents may have risen along it.

The conglomerate here, as in George's claim, forms a very bad roof, necessitating close timbering. The props are spaced three to four feet apart, and laths are carried overhead at the face. The waste material is stacked behind the working face, as in coal-mining.

Donaldson's.—West of Cockson's.

The shaft is 127 feet deep, bedrock having been entered at 120 feet. Work is now going on at 70 feet east of the shaft, in a belt of auriferous "wash," running south-west along the western side of a "bar" 16 feet high. The ground to the "bar," about 100 feet east of the shaft, has been worked out over an area 80 feet long.

The "wash" is known as blue ground, but the pebbles, though less decomposed, are of the same nature as in the shallower white ground, into which, in fact, the blue ground gradually fades. It is said to be "mellow," and likely to be rich when composed of subangular fragments of blue schist, while, when the "wash" is well rounded and contains much quartz, it is said to be "hungry" or "drift." Boulders of rotten granite occur throughout the "wash." The "cement" ground at the shaft is reddish, and very hard, carrying about 12 dwt. to the load. The "cement" continues to the north and north-west of the shaft, but, on the opposite side, it is soft, and known as "puddling wash." The gold is "rubbly," averaging ¼ dwt. in size, but one ounce colours are occasionally found, and one of 35 dwt. has been reported. The percentage of flaky gold is small, but both "specimen" (*i.e.*, attached to quartz) and fine gold occur.

For treatment four inches of "wash" and four inches to six inches of bedrock are raised. The total output was given me as 230 loads for an average yield of about one ounce per load (of 1¼ tons), though running as high as two ounces, so that this must have been one of the richest claims.

A $\frac{1}{16}$-inch layer of rich gold-bearing "sediment" (probably flucan) is to be seen throughout the claim, between the "wash" and bottom. It has much the appearance of a plane of movement. That it is such is proved by the occasional pockets of "wash" below it (differing from that immediately above), and the masses of crushed schist above it (differing from the bedrock below). One such pocket is shown in Fig. 2. The layer is reported to increase to ½ inch in thickness at the "drops," as should be expected if it is due to sliding of the coal measures on bedrock.

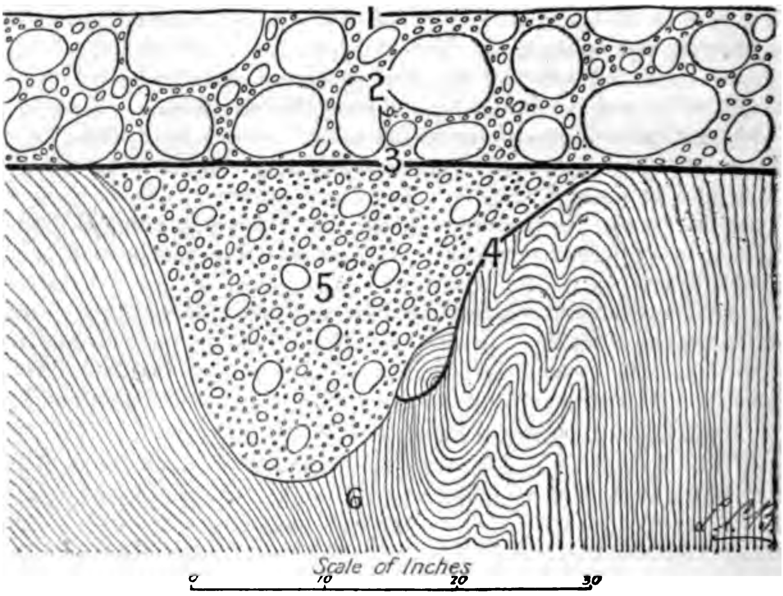

FIG 2.—POCKET UNDER "PUG" SEAM, DONALDSON'S CLAIM, BLACK RIDGE.

1. Roof of drive.
2. Gold-bearing "wash."
3. Gold-bearing "pug"—slickensided fissure.
4. Slickenside on bedrock.
5. Sandy "wash."
6. Schist.

The slope of the bottom in the latest workings is 1 in 12 westerly (between west-north-west and west-south-west), but the general slope is to the west-north-west. It is affirmed that after the rise (on the "bar") of 16 feet, above referred to, the slope is very slight for 30 feet, when there is a second rise of six feet to a terrace known as Williamson's. This is looked upon as the most even ground at the Ridge, there being no bumps or pot-holes, and the only falls being from one "terrace" to another.

The schists (bedrock), sometimes very soft, are on edge, and this probably favourably influenced the deposition of gold in the "wash." They are seamed by great numbers of quartz leaders, and, when these project above the bottom, it is found that the gold occurs in the schist as much as six inches below the "wash." The occurrence of dykes is denied.

It has been noticed that in damp weather a few cupsful of water "make" in the shaft bottom, though there is no sign of water at ordinary times. It has, therefore, been concluded that this slight amount of moisture is always exuding from the quartz leaders in the schist, but in dry weather is evaporated as fast as it reaches the surface. It points to the occurrence of circulating water otherwise unsuspected, which may be even now engaged in enriching the "wash."

The use of ironbark tram rails (1½ inches by ¾ inch), not only for the straights but also for the curves, is interesting from an engineering point of view. The rails are bent into graceful curves, and kept in position by insertion in grooved sleepers. As was remarked, it requires very little more trouble to set them than the ordinary short straights, and this is far more than compensated by the ease of maintenance and running, the trucking from the face to the shaft being always looked upon as one of the most expensive factors in mining here.

Burn's (Davidson's old).— South of Donaldson's.

The main shaft is 127 feet deep. The ground east, south, and west of the shaft has now been practically worked out. The run at present being worked is on a steep fall to the west and north-west, on Donaldson's boundary, north-east of the shaft.

The "wash" is considered "hungry," being mostly well-rounded, with a considerable proportion of quartz pebbles and light-brown rotten granite, but very little schist, and very few "pilots." On the cracks of some of the quartz pebbles are films of marcasite, deposited since the quartz reached its present position, as proved by its sometimes partly encrusting the pebbles.

Only two inches of "wash," with six inches of bedrock is raised from the southern face (for returns of ½-oz. to the load), though more was taken from the northern faces. Burn's output totals—

39 loads, for yields of from 7 dwt. to 10½ dwt. per load.

On Donaldson's boundaries the "wash" is believed to average 13 dwt. to the load.

The bottom is very uneven, in the present face being alternately flat and very steep. The average slope is 1 in 10 (in one place it increased to 45°) to the west, but on the southern face there is one local slope to the east.

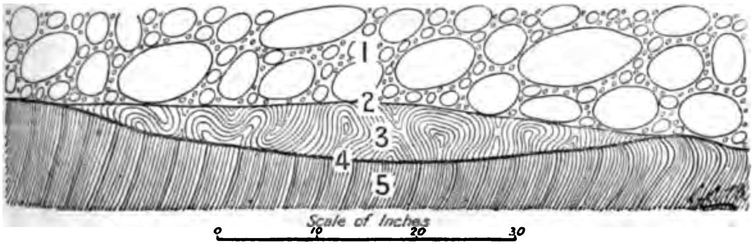

FIG. 3.—SCHIST ABOVE SLICKENSIDED "BOTTOM," BURN'S CLAIM, BLACK RIDGE.

1. Coarse hungry "wash."
2. Original "bottom," no slickensides.
3. Crushed soapy schist.
4. Strong slickenside ("bottom.")
5. Soft blue and white schist.

The signs of movement that has taken place between the coal measures and the schists are very plain. The sketch above (Fig. 3) shows the present slickensided bottom under a small, much-crushed projection of the bedrock (which carries good gold). The movement of the coal measures was, in this case, from west to east, as proved by the bending over of the schists. Very little, if any, movement can, however, have taken place near the north-eastern face now being worked, where there is only occasionally any slickensided surface between the "wash" and bedrock. Slickensided surfaces sometimes glance into the bottom, and the schist above them is then auriferous. This surely points to secondary enrichment of the "wash" as well as of the upper surface of the bedrock.

The soft schist forming the bottom, dipping steeply to the south, and striking east and west, is on edge. It is thinly laminated, white and blue, with numerous lenticular quartz leaders, which, however, seldom reach to the "wash," but when they do reach it, the latter is specially rich in gold.

(*n*) NORTHERN WORKINGS.

These are on the flat on the western side of Gowrie Creek, below (*i.e.*, to the north of) the Old Cricket Ground, and extend for a distance of ¼-mile, with a width of up to ten chains.

"Billy" up to 20 feet in thickness occurred in patches under that part of the flat nearest the Old Cricket Ground.

The old puddler well, a little over seven chains north of Noonan's store, is said to have been sunk through 20 feet of basalt, above 19 feet 6 inches of "billy," and then through "sand" to the "headings" (*i.e.*, the "wash") at a depth of 78 feet. It is reported that a seven ounce nugget was obtained in this claim.

The most northerly holes are in 20-feet ground, consisting of five feet black soil over pipeclay and white clayey "wash," dipping 1 in 6 to the south-west). The schist bottom does not appear to have been reached in the workings.

East of these last a considerable number of shallow holes (eight to ten feet deep) were sunk in 1892 along the bank of Gowrie Creek, but there are no records as to the values obtained. These are connected with Fox's Lead by an area of "surfacing."

(*o*) HILLSIDE CLAIMS.

These claims are on a line, upon the western slope of the Gowrie Creek depression, connecting the workings on the Old Cricket Ground and those on the Deep Ground.

Ford's.—West of Donaldson's.

The shaft is 152 feet deep (on bottom). A very slight seepage was encountered about four feet above the bottom of the shaft, but there was not sufficient water to cause any trouble.

A chamber has been worked out all round the shaft, but most of the work has been to the south-east, the area worked in August, 1904, being 30 feet in diameter.

The "wash" consists principally of well-rounded slate and schist pebbles with little quartz. It is referred to as "puggy," each pebble having a clayey coating, which is probably triturated material due to earth movements. The gold occurs in little "dabs" and is very patchy.

About fifty loads have been puddled for a yield of 7½ dwt. per load.

The bottom is slickensided as a rule, though in some parts it is very uneven. Its slope varies bewteen one in twelve and one in five, the fall on the whole being to the north-west; but at the shaft there is a local slope of 1 in 12 to the east.

The stratification, or rather lamination, of the schists (which are not quartz veined) is, in this claim, generally nearly conformable to the slope of the bottom, and conditions have, therefore, not been very favourable for the retention of gold.

McMillan's.—West of Burn's claim. Work has been going on here since Christmas, 1903.

The shaft is 150 feet deep (to "wash"), and the sinking took six weeks. The run was worked easterly to the boundary, and then in a southerly direction from the shaft, spreading out to the west. The present face is about 100 feet south-west of the shaft, and is being carried forward westwards.

The "wash" is composed chiefly of slaty pebbles, but granite (only slightly decomposed) is very plentiful, and "pilot-stones" are found in great numbers, while quartz, on the contrary, is scarce. The pebbles dip north-west in the present face. The gold is fairly coarse, and is characteristically "ragged" (*i.e.*, sharply angular in form).

It has been found that the lower four inches of "wash," and the upper three or four inches of bedrock carry the gold (which is more plentiful in the latter). The following are the returns to the middle of 1904:—

15 loads yielded	10 dwt. per load
20 loads (from the S.W. drive) yielded...	24 dwt. per load
16 loads yielded	15 dwt. per load
28 loads yielded	12 dwt. per load
Total 79 loads, for an average of	15 dwt. per load

The slope of the bottom is generally westerly or south-westerly.

The schist (bedrock) shows great variety, but laminated white and blue is most common. The dip near the shaft is 45° to the east, but elsewhere, if not contorted, it is nearly perpendicular. Quartz leaders occur in the schist, but they are always barren.

Smith's ("The Fraud").—South-west of McMillan's.

The shaft is 177 feet deep, and was sunk in eight weeks, the strata passed through being pipeclay for 10 feet from the surface, and then "cement" (*i.e.*, conglomerate) to the bottom.

A block of ground, about 30 feet in diameter, has been worked out north-west of the shaft, the present workings running to the east.

The "wash" is chiefly composed of slaty rock and quartz-veined quartzite, with a few quartz pebbles (most of which contain pyrite), and some biotite granite. The pebbles in the faces east of the shaft are inclined, like the bottom, to the west. Thin patches of sooty-black carbonaceous shale (emitting a distinct odour of kerosene when heated in a candle-flame), containing impressions of plant stems, are not uncommon in the "wash," and seem to dip with the bottom. These generally occur above the auriferous portion, and, owing to their fissility and greasy surfaces, often allow the "wash" to slip away from under them or fall away themselves, and they are hence known as "soapy or slippery heads." Other planes formed by fissuring and sliding of one part of the rock upon that adjacent occur not only in the "wash" but also in the bedrock. Water with a sweet taste seeps out of the "wash" north of the shaft, and from it on exposure is precipitated a quantity of red hydrated oxide of iron.

The gold is fine and scaly or flaky, and most of it occurs on the bottom.

The stone for treatment includes six inches of "wash," and from four to six inches of bedrock. The output, in September, 1904, comprised—

46 tons, yielding 32 oz. 10 dwt., equal to 14 dwt. 3 gr. per ton:
and 50 tons in paddock, expected to run 14 dwt. per ton.

The Warden gives the total output for 1904 as—

230 tons for a yield of 133 oz., equal to 11 dwt. 3 gr. per ton.

The absence of any "pug" between the "wash" and bedrock is noticeable; and the irregularity of the bottom is considerable, the general slope being westerly—from 1 in 10 to 1 in 20.

Bedrock is hard schist, dipping steeply to the south, as a rule, though in the north-western face, where it has been faulted, the laminations are seen to be both vertical and horizontal. (*See* Fig. 4.)

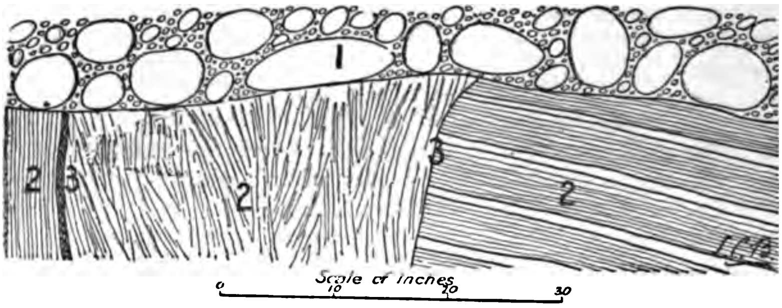

FIG. 4.—CHARACTER OF SCHIST, SMITH'S CLAIM, BLACK RIDGE.

1. "Wash." *3. Fissures and faults.*
2. Vertical, contorted, and gently sloping schists.

A thin leader seemingly intercalated between "wash" and bed-rock, such as was spoken of by many miners, was seen here. Close inspection proved that the leader had been originally entirely surrounded by schist, though it may appear to be now in process of formation, the lower part in the schist being solid white, the upper part (under clayey "wash") loose and sugary. East of the shaft leaders one half-inch to two inches thick and six inches long are plentiful.

Moxham's Leap (abandoned).—Ten chains west-north-west of Noonan's store.

This inaccessible shaft is 185 feet deep. Though on the edge of an area of "billy," only boulders of that rock were met in sinking.

Several loads, containing up to 12 or 13 dwt. per load, are reported to have been raised. The "wash" had, however, to be troughed or puddled by the miners themselves, there being no puddling machine at the Ridge when the claim was worked (in 1897), and, under those circumstances, the ground was considered too poor to hold.

The probability is that the ground would now pay to exploit. The deserted claim has, indeed, once been taken up with the idea of trying it, but it was found impossible to carry on operations, owing to the extreme smallness of the shaft, and means were not available for the sinking of a new one.*

(c) DEEP SINKING.

The separation of the claims west of Smith's is entirely conventional, the term Deep Ground having been arbitrarily given while miners were hesitating as to whether or not to peg out ahead of McGillivray and sink. To sink a 240-feet shaft and erect a whip meant the expenditure of £15 or £16 per man, in addition to several months of unremunerative work.

(*a*) OLDER CLAIMS.

The claims begin with Mason's, on the eastern edge of the basalt plateau. In this claim McGillivray first (in 1902) struck payable gold, a run mostly poor, having been followed from the head of Gowrie Creek through the Blue Ground. The mining community seems to have been given to understand from McGillivray's party that their ground was not rich, and that the "run" was making to the north-west.† The Bedfords, in consequence, took up a claim in that direction, and sank a shaft, but the ground proved poor; and no further attention seems to have been given to the matter till McGillivray took up his present claim on the west of his old one, thus denoting the real direction of the continuation of the run of gold. (Plate 9.)

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* It was reported in August, 1905, that a trial crushing from the shaft of 75 tons had yielded 22 dwt. per ton.

† Since writing this report, word has been received from Mr. McGillivray objecting to this as "misinformation." He gives as reasons why miners would not work ahead of him the following:—(i.) Water expected; (ii.) Shooting ground in sinking and workings; (iii.) Belief that 1-oz. dirt unpayable; (iv.) Gold spread so that it was impossible to tell which way the "run" lay; (v.) Several miners down shaft; (vi.) Bedfords sank a shaft after compassing McGillivray's ground.

There is as yet little to form a guide as to how the auriferous ground will continue. The contour of the bottom indicates that depressions from the south and from the east junction on the Eldorado, and that the continuation thence is to the north; nevertheless, it will not necessarily be the case that the richest gold will be found in this depression, for to all appearances it is now on the western slope.

Mason's (McGillivray's Old).—South-west of Smith's.

The shaft is 208 feet deep, ten feet being in bedrock. In sinking, an open crack, dipping steeply to the north, was met in the "cement," but it did not extend into the bedrock. It yielded 300 gallons of water per day, though the water is now 40 feet below the shaft bottom.

The present workings are on the north, and about 30 feet distant from the shaft. They are beside a "bar," which has been traced for hundreds of feet. The main drive runs south-south-west across the dip to below the water-level. McGillivray's workings lie to the west of this, and extend to the boundary of his present claim. Another drive was carried 200 feet to the east of the shaft, apparently in poor ground.

The "wash" is very hard ("cement"); it carries a fair amount of quartz, and a considerable quantity of granite. Long thin flakes of carbonaceous shale occur in it, and, when near the base of the "wash," form "false bottoms" for part of the gold. It is understood that in one place in the old workings a 1½-inch coal seam came down on to the "wash," which was then barren, till the seam again passed into the roof. In the old drive epsomite (hydrous magnesium sulphate) effloresces abundantly from the "wash," which at the same time disintegrates into a fine powder; and these effects are presumably due to the decomposition of pyrite or marcasite in the "wash." Slickensided penthouse "heads" are found all along the main "bar" referred to above. These must have originated in connection with the formation of the "bar," which is really an abrupt fold or fault to the west.

Gold was found, not alone along the crest of the "bar," where two-ounce crushings were obtained, but also, contrary to the usual occurrence, on both sides of it. On the eastern side the "wash" (in other claims not expected to carry more than a few grains) yielded seven pennyweights per load. Gold was followed in a drive down to the 240-feet level, and the "headings" raised from it were, at the time of my visit, being hand-picked and dry-blown, evidently with profit. The gold is not flaky.

Up to six feet of "wash" has been crushed in the past, but the amount taken usually varied between eight inches and two feet, while

Photo., L.C.B. GENERAL VIEW OF DEEP SHAFTS, BLACK RIDGE. **Plate 9.**

just at present only six inches is removed. McGillivray's monthly output during the time he worked this claim is stated to have been—

50 tons, averaging 18 dwt. per ton (from 11 dwt. to 2 oz.).

Mason, taking six feet of "wash" from near the "bar," has crushed—

51 tons, for a yield of seven pennyweights per ton.

By taking only six inches from the ground north of the shaft, a crushing in August, 1904, of—

49 tons yielded 35 oz., or an average of 14 dwt. 7 gr. per ton.

The total yield for 1904 was (according to the Warden)—

81 tons for 54 oz., equivalent to 13 dwt. 4 gr. per ton.

The bottom here is much steeper than in any other claim, the inclination varying from 1 in 6 to 1 in 12 to the west.

The schist (bedrock) is generally on edge, the dip, which is by no means constant, being either to the east or to the west. In the latest workings, to the south-east of the shaft, where there was six feet of very rich "wash" filling a pot-hole, the schists, rather thick bedded and slaty, dip in nearly the same direction as the "wash," but at a greater angle. There are very few quartz leaders, and gold is found in them only when they are cracked on the surface.

Bedford's.—North of McGillivray's.

This claim has, according to the sketch map published with the annual report by the Warden, been taken up by Mason and party, and is also referred to as "Hickey's Claim." As already mentioned, Bedford's shaft was sunk early in 1904, in the belief that McGillivray's run of gold trended northwards.

The shaft (inaccessible at the time of my visit) is 209 feet deep. Drives were carried from it 60 feet south, 40 feet east, 10 feet north, and 20 feet west.

Very little "wash" was found as a result of the driving, the gold, most of it "shotty," varying from colours up to ½ dwt. to the dish (the latter in gutters running north-west). The Warden gives a return, in his annual report, as from Hickey's Claim, of—

15 tons for a yield of 15 oz., equal to one ounce per ton.

This is rather a good return, especially if, as presumed, from Bedford's shaft.

The slope of the bottom is said to have been 1 in 4 to the north-west.

If the above information is correct, there should be every probability of payable gold being struck north-west of this shaft—say towards Chadwick's.

McGillivray's ("Nipper").—West of Mason's. This claim includes ten men's ground.

The shaft is 218 feet deep, and was sunk in eight weeks. The strata passed through include—

Sandy and gravelly sediment	30 feet
"Pug"	15 feet
Blue "cement"	20 feet
"Cement"	35 feet
Blue "cement"	118 feet

Considerable water was met with in sinking the shaft, which was presumably sunk in a comparatively porous portion of the strata, forming a reservoir, for there has not been the slightest trouble with water since opening out. From the shaft a drive was opened to the south-south-west to the boundary (69 feet distant), in order to connect with Fraser's workings, for ventilation. A north-west and south-east run of gold was met just inside the boundary, on the south-western side of which there is a steep fall or roll of three to six feet. This run is now being worked eastwards and westwards.

A black band (which is also found in the claims to the west) in the "wash" about two feet above bottom, was first met in this drive. All the "wash" requires to be blasted down.

At first the claim holders took down 15 to 18 inches "wash," but the average for the year was only seven inches. In August, 1904—

60 tons had been crushed. for a yield of 16 dwt. per ton,

and the Warden's figures for the whole year (1904) are—

349 $\frac{17}{20}$ tons for 261½ oz., equal to 14 dwt. 23 gr. per ton.

During February, 1905—

45 $\frac{10}{20}$ tons yielded 34 oz., equal to 15 dwt. per ton.

The slope along the drive is 1 in 23, but that is diagonally to the steepest, which (averaging 1 in 10), is to the west-south-west, this direction appearing also to be the run of the auriferous ground.

The bedrock consists of bluish-green mica-schist, dipping steeply (1 in 3 to 1 in 5) west and west-south-west. This forms a very rough bottom, and sometimes the quartz veinlets, intercalated in them, and projecting above the general surface, have acted as additional riffles in saving the gold.

Fraser's ("True Blue").—West of McGillivray's. The claim embraces 30,000 square feet (six men's ground). Four men in the face, one at the shaft bottom, and one at the brace (whipman), break down and raise one to four tons a day.

The shaft is 223 feet deep, and was sunk in twelve weeks, with an expenditure per man of £16. To a depth of 80 feet the sinking consisted of variously-coloured sediments (no basalt), below which was a few feet of yellow gravel, and then hard shooting ground (blue conglomerate), the lowermost part of which is the auriferous "wash."

As already mentioned, the shaft is connected with McGillivray's by a drive, in which prospects of up to five and six grains to the dish were obtained. The ground worked out in August, 1904, extended 50 feet east and 50 feet west of the shaft.

The " wash " consists of white quartz and pebbles of green schist, with much granite embedded in a cement of the same colour.

The boulders are seldom more than a foot in diameter, (an exception being just to the north of the shaft, where they are up to three feet long), but the " wash " here, as a whole, is coarser than that in either of the adjoining claims. The boulders seem mostly to be inclined to the north-west, which would indicate that, if alluvial, the transporting stream came from that direction. There are also rather numerous patches and lenses of " tish " (a rock made up entirely of fine or coarse angular fragments of schist, with every appearance of a detrital talus deposit) which is quite barren, though gold occurs both in the coarse " wash " above and in the fine " wash " below it. The thin band of black silt first found in McGillivray's continues in this claim, often acting as a " false bottom," when there is gold above but not below it. Most of the gold occurs attached to the boulders of granite and " black rock" (a kind of "pilot-stone").

Up to three feet of " wash " is taken for treatment, the average being 15 to 18 inches, with three inches (six or eight inches when soft) of bedrock. In their eastern face the miners were just getting on to good gold (two pennyweights to the dish), the " wash" at the same time becoming darker in colour, and carrying a greater proportion of schist fragments. There is in that part also a distinct " dig" or " pug " seam between the " wash " and bedrock. The output includes—

50 tons (from S. of shaft) crushed, in Feb., 1904, for 17 dwt. per ton
56 tons (from S.W. of shaft), in March, 1904, for 16 dwt. per ton
76 tons (from W. and S.E. of shaft), in May, 1904, for 14 dwt. per ton
81 tons (from drive to McGillivray's), in Sept., 1904, 12¼ dwt. per ton

while the Warden in his Annual Report gives the total for 1904 as—

$400\frac{4}{25}$ tons crushed for 460 oz. 12 dwt. = 1 oz. 3 dwt. per ton.

An additional 200 tons were crushed in May-June, 1905.

In a western face, about 40 feet from the shaft, the conglomerates seem to have slid over the schists, shearing off bumps and slickensiding the bottom. The slickensiding is, however, not continuous throughout the claim, and the following example was secured showing how small the movement must have been, and that when shearing did not take place crumpling of the underlying schists resulted:—

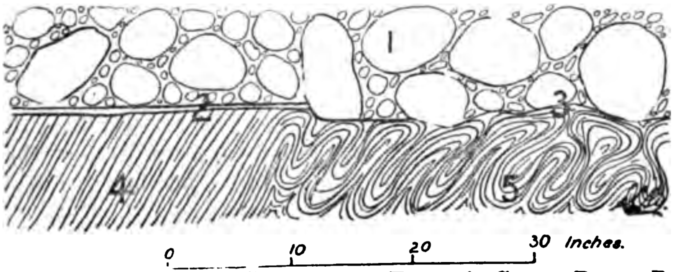

FIG. 5.—SHOWING END OF SLICKENSIDE, FRASER'S CLAIM, BLACK RIDGE.

1. *" Wash."*
2. *Bottom with slickensides.*
3. *Bottom without slickensides.*
4. *Foliated schists.*
5. *Crumpled and slickensided schists.*

The inclination of the bottom is, on the average, 1 in 12 to the west-north-west (varying between north-west and south-west).

The bedrock is blue and white granular schist, veined with quartz, generally on edge, and sometimes contorted.

Hennessey's ("Eldorado").—West of Fraser's. This is an area of 30,000 square feet, which is six men's ground.

The shaft is 242 feet deep, and was sunk in fourteen and a-half weeks; explosives, claim expenses, &c., per man, amounting to £16. The following strata were passed through in sinking:—

Black soil	3 feet
Basalt	2 feet
Conglomerate and shale	145 feet
Coal seam (dipping 15° to the N. W.)	4 inches.
Shale and fine loose conglomerate	20 feet
Shale band (dipping S. W.)	1 foot ?
Shale and fine loose conglomerate	46 feet
"Cement"	10 feet

The claim at the end of 1904 was making 60 gallons of water per day.

The first work done consisted in the excavation of a chamber (16 feet in diameter) on the southern side of the shaft, from which a prospecting drive was continued to the south-by-west for 40 feet to what was considered the edge of the run. From their work the miners took it that the run was heading to the south-west. The area worked for the year's crushings is given by the Warden as 70 feet by 60 feet.

The "wash" on the eastern face was very granitic, and very rich in gold, the flakes of which were observed to be, more often than not, on their edges, which would not be the case if they had been deposited from mechanical suspension. The occurrence of "paint gold" in the schists also points to secondary enrichment. The gold in the wash is "shotty." The biggest colour found during 1904 was one of seven pennyweights, but one waterworn slug of 6½ oz. weight has since been found.

For the earlier crushings only six inches of "wash" and six inches of bedrock were saved—sometimes only six inches altogether—but it has since been found that the gold extends for some feet into the headings. The first crushing, in June, 1904, was—

22 tons, yielding 126 oz. = 5 oz. 14 dwt. 13 gr. per ton.

Another, in August, 1904, was—

38 tons, yielding 191 oz. = 5 oz. per ton.

And, in September, 1904—

50 tons yielded 123 oz. 8 dwt. = 2 oz. 9 dwt. 9 gr. per ton.

In consequence of these results, it was decided to put through the 200 tons of "headings" on the surface, and they are probably included in the Warden's total for the year—

316$\frac{1}{20}$ tons, for a yield of 591 oz. = 1 oz. 12 dwt. 18 gr. per ton.

In February, 1905—

75 tons were crushed, for a yield of 23 dwt. per ton.

The strong slickensides on the bottom point to movement of the overlying coal measures having taken place.

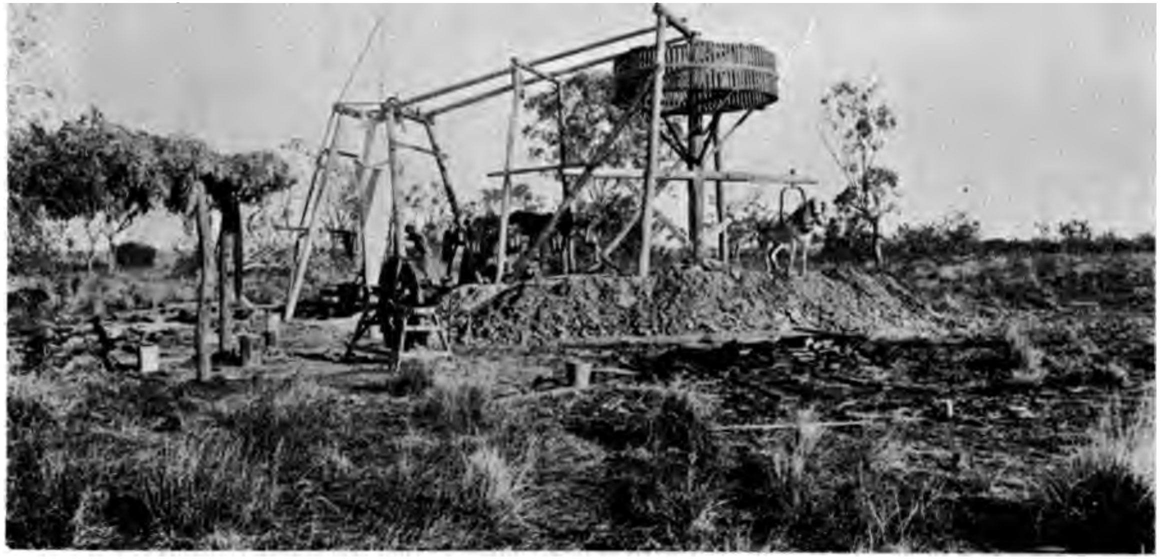

Photo., L.C.B.

MADGE'S WHIM, BLACK RIDGE.

Plate 10.

In the southern crosscut, the only place that had been opened at the time of my inspection, the slope (rise) increased from 1 in 20 near the shaft, to 1 in 5 at the end.

The bedrock is a blue chloritic slate, very thin bedded in places, and then practically a schist, dipping at angles from 30° to 90°, and sometimes contorted. For four or five inches below the "wash" the rock is softened, and, in that part, gold occurs painted on the laminæ; below that the slate is hard.

Heuat's ("Bantam").—West of Hennessey's. Six men's ground.

The shaft had not reached bedrock when I left the field, but the Warden has since reported that it was struck at a depth of 240 feet (first reported as 237 feet), of which 130 feet was sunk in seven weeks. The strata pierced are as follow:—

Black soil	2 feet
Basalt	50 feet
White gravel	25 feet
Sediments	30 feet
Hard red and blue conglomerate	43 feet
Hard red and blue conglomerate	58 feet
Grey shale (flat) cut in Hennessey's at 170 ft. depth ...	1 foot (?)
Hard conglomerate	

In February, 1905, a drive had been carried from the shaft south-west to Herbert's boundary, 130 feet distant, for the purpose of connecting with his workings, and so ensuring ventilation. The drive proved payable "wash" throughout its length, that at the base of the shaft yielding five grains to the dish.

At the end of September, 1904, the following crushing was reported, three feet of wash being treated:—

30 tons for 42 oz. = 1 oz. 8 dwt. per ton.

The average thickness of "wash" broken down for treatment during 1904 was two feet, and the crushings to the end of 1904 amounted to—

135 tons for a yield of 188 oz. = 1 oz. 7 dwt. 20 gr. per ton.

In March, 1905—

62 tons were crushed for a yield of 66 oz. = 1 oz. 1 dwt. 8 gr. per ton.

Madge's ("Pumpkins").—West of Heuat's. Six men's ground.

The shaft, contrary to all expectation, bottomed at 220 feet, whereas, according to the average dip from Mason's to Fraser's, it should not have reached bedrock for another 100 feet. The sinking (pick work) below the basalt was at the rate of two feet a day, with three shifts; and the total time occupied in sinking the shaft was ten weeks and two days. Madge holds that the contract price locally for sinking a well as deep as his shaft would be £280. Basalt (the only part requiring shooting and timbering) was passed through from the surface soil to a depth of 92 feet. Below that were conglomerates, sandstones, and shales, from the last of which a number of fossil plants impression (mostly of *glossopteris*) were collected by me, but they have not yet been described. The bottom slopes 3 in 5 to the west. Water, at the rate of 40 or 50 gallons a day, came into the shaft 20 feet below the basalt, but towards the end of the year the amount raised from the workings was 200 gallons. When the mine was inspected, a drive had been opened for 31 feet to the north-north-west, in which distance the fall was four or five feet.

At the shaft bottom there is no "wash," but instead a band of "sediment," dipping less steeply than the bottom, so that it passes into the roof along the drive. A conglomerate bed overlying shale appears about 10 feet from the shaft, but the "wash" did not come in till near the face of the drive, where there is a sudden drop of 1 in 2 to the east by north. This "wash" consists of much rounded schist, and was on the edge of the blue ground. The first prospects of gold were obtained 25 feet from the shaft, and they continually improved till in the face $\frac{1}{4}$ dwt. to the dish (equivalent to over an ounce per ton) resulted. At this point the "wash" had increased to two or three feet in thickness. The "channel" was therefore presumed to run north-north-west, in which case Heuat's workings would be on the eastern side and Madge's on the western, as indicated by the general contour of the bottom, shown by the depth of the shafts.

During 1904, 14 inches of "wash" was taken, but at the beginning of 1905 five feet was being raised for treatment. Some of the "wash" proved exceedingly rich, five dishes from one part yielding 70 oz. of gold. In October, 1904, the following result was obtained:—

40 tons crushed for 111 oz. = 2 oz. 15 dwt. 12 gr. per ton.

The output for 1904, as given by the Warden, was—

97 tons for a yield of 307 oz. = 3 oz. 3 dwt. 7 gr. per ton.

In February, 1905—

$45\frac{10}{20}$ tons were crushed for 51 oz., equal to 21 dwt. per ton.

Pengelly and Young's.—North of Hennessey's and Heuat's. The claim comprises nine men's ground.

The shaft, which was in process of sinking when I left the field, is 243 feet deep.

The "wash," one foot thick, was not rich at the shaft, but improved southwards, prospecting from $\frac{1}{2}$ gr. to $\frac{1}{2}$ oz. to the dish. Mr. Young has written me that when a superimposed coal seam approaches the bedrock the "prospects" are always poor.* He also records the finding of a waterworn pebble of quartz, weighing 4 oz. 11 dwt., which on dollying yielded two ounces seven pennyweights of gold; and that when the "wash" is heavy the gold, though not necessarily coarse, "weighs well"—that is to say, it is dense and solid.

The Warden gives for the year 1904—

38 tons crushed for 18 oz. = 9 dwt. 11 gr. per ton.

The returns for February, 1905, are—

36 tons for $27\frac{1}{2}$ oz. = 15 dwt. 7 gr. per ton.

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* Mr. Donald Fraser informs me, however, that a bed of coaly-shale found above the "wash" in the sinking in the richer claims was always absent in the "duffer ground."

In March, 1905—

76$\frac{10}{20}$ tons yielded 74 oz. = 19 dwt. 8 gr. per ton. Value, £4 per oz.

In June—

102½ tons were milled for 52 oz. 5 dwt., equal to 10 dwt. 5 gr. per ton.

Raynor's ("Last Chance").—North-east of Madge's. There is six men's ground in this claim. Exemption was secured in April, 1905.

The first shaft (in process of sinking when I was on the ground) was abandoned at a depth of 120 feet, on account of the inflow of water. A second shaft, 242 feet deep, was sunk, at a cost of £118 (presumably exclusive of labour). Drives were then opened for 30 feet east and west, and for 33 feet north and south, without striking payable gold. A trial crushing, in February, 1905, gave—

23½ tons for a yield of 11½ oz., valued at £46.

Chadwick's (abandoned).—Nearly a mile north of Heuat's.

The shaft (inaccessible) is 216 feet deep. No "billy" was struck in it, though there is considerable on the surface in the vicinity. Drives are said to have been opened for 27 feet north-east, and 21 feet east.

There was up to six feet of "wash," agreeing in character with that at the Ridge, and containing great quantities of biotite granite, but colours of gold were found in the 12 inches on bottom.

The bottom is said to have been flat.

The bedrock is green chloritic schist.

(*b*) NEWER CLAIMS.

The following claims have been pegged out on the Deep Ground since my visit, and the particulars have been taken from Press notices, Warden's reports, and other sources:—

Northern.

Croft and Madge's.—West of Madge's ("Pumpkins"). Six men's ground.

Shaft is 204 feet deep.

The wash is freer than usual, and the bottom is soft.

The thickness broken down is two feet, and in April, 1905, the following crushing was made—

62 tons yielded 33 oz. = 10 dwt. 15 gr. per ton.

August, 1905: Taking a big body of stone—

82 tons yielded 52 oz. = 12½ dwt. per ton.

Lloyd's.—West of Croft's. Six men's ground.

Shaft in May, 1905, was 115 feet deep, and was making considerable water. Exempt, June.

Smith and Topham's.—North-west of Finger's. Six men's ground. Shaft in process of sinking; 140 feet deep at the end of May.

Ambrose ("Family Circle").—North-east of Raynor's, and north-west of Pengelly's. Nine men's ground.

The shaft is 245 feet deep. The influx of water amounted to 2,500 gallons per day.

The "wash" struck was unpayable, and a 100-feet drive had failed to find any in February, 1905.

Exemption was secured in April, 1905.

Dequin's ("Perseverance").—North of Raynor's. Exempt in May.

The shaft was 136 feet deep in February, 1905, and still being sunk, the influx of water being 600 gallons per day.

Tasker's ("Endearer" or "Spaniard's").—North of Raynor's. Six men's ground. Exempt in May.

The shaft had reached beneath the water zone at 135 feet, and bottomed unexpectedly at 195 feet depth. It is proposed to continue it, and drive to the "wash." This has been proved to be payable to the dip, which is steep, and to the north-east.

Neight's.—West of Dequin's. Six men's ground. Exemption was obtained in April, 1905.

Sinking stopped in April, 1905, at 122 feet depth, owing to the inflow of water (1,300 gallons per hour), but has since been continued.

Wyles' ("Ruby").—North-west of Neight's. Six men's ground. This is the outermost claim on the west. Exemption was granted in April, 1905.

Water amounting, in February, 1905, to 120 gallons per nine minutes, was met at 95 feet depth. In May 115 feet depth had been reached.

Finger's ("Dolphin" or "Douglas Creek").—North of Dequin's. Nine men's ground. Exempt in June.

The shaft is 256 feet deep—the deepest on the field—and a drive has been opened for 30 feet.

The "wash" contains only fine "colours," so far (May, 1905).

Wolf's ("Daisy").—East of Dolphin. Six men's ground..

Sinking.

Borl's ("Contract").—North of Finger's and Wolf's. Nine men's ground. Abandoned, and secured by a second party (Linton's) in May, 1905.

The shaft had reached a depth of 200 feet in May, and till "wash" is reached no further sinking will be undertaken north of this claim.

Comorty's.—North of Finger's and Dequin's.

No water to 65 feet depth, in February, 1905.

Southern.

These claims are being taken up on the ground between the Deep Shafts and Daintree's Knob. Most of them are reported in the Press* (April, 1905) to have patchy ground, with very irregular prospects, but the gold is thought to be coarser, as a rule, than to the north.

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* "The Peak Downs Telegram."

Herbert's ("McLoskey's Mistake").—South of Madge's and Heuat's. Six men's ground.

The shaft is 229½ feet deep, and 80 gallons of water are raised per day.

There is nine inches of "wash" at the shaft bottom, and it is reported to be "good." In March, 1905—

52 tons were crushed for 30½ oz. = 11 dwt. 17 gr. per ton.

Taylor and McMillan's ("Hope").—South-east of Herbert's. Six men's ground.

The shaft is 230 feet deep, and a prospecting drive has been opened.

The "wash" here at the shaft was sandy "cement," carrying only fine colours of gold, but working out from it a 17-dwt. colour was found, and there has been one crushing of 24 dwt. per ton.

McDonnell's ("Just-in-Time").—South-east of Fraser's. Six men's ground.

The shaft is 236 feet deep, the schist being struck at 233 feet. No water was met in sinking.

One slug of three ounces has been found, and three or four of one ounce.

The two feet of "wash" at shaft gave one-ounce prospects. Gold-bearing "wash," one to three feet thick, has now been traced down a long sidling. During the first quarter of 1905—

81 tons were crushed for 173 oz. = 2 oz. 2 dwt. 17 gr. per ton.

August, 1905—

84 tons yielded 106 oz. = 1 oz. 5 dwt. per ton.

The prospects of this claim are thought by some to be the best at the Ridge.

Campbell's ("Moonshine").—South of Fraser's.

Sinking.

O'Hara's ("Blackbutt").—West of McMillan's. Six men's ground. Abandoned, June.

The shaft is 199 feet deep, but was a "duffer"—that is to say, the "wash" there is barren.

Allan's.—The shaft is 184 feet deep, and was abandoned in April, 1904.

Ford's ("Waratah").—South of McMillan's and McDonnell's.

The shaft is 208 feet deep.

The ground is patchy, and, on the whole, there is little gold in the eight inches of auriferous "wash."

Greave's and Meare's ("Brilliant").—South-east of Ford's.

The shaft is 214 feet deep.

In February, 1905, a crushing of—

24 tons yielded 9 oz. 10 dwt. = 7 dwt. 22 gr. per ton;

and in April another crushing resulted in 7½ dwt. per ton.

Donaldson's ("Hopeful").—South of Pugh's. Six men's Abandoned, June.

The shaft is 158 feet deep. It proved a "duffer."

Agnew's ("Eureka").—South of Ford's.

Sinking.

Lyall's ("Excelsior").—South of Greave's. Six men's Abandoned, June.

The shaft is 209 feet deep, the schist being struck at depth.

There is little gold in the "wash."

There is reported to be a considerable body of "wash" a fair average gold content; but a trial crushing of—

19 tons gave only 3 dwt. per ton.

The bottom slopes at about 1½ in 1 to the east.

Fogarty's.—This claim includes Williamson's old shaft.

Reported fair prospects.

Pugh's.—South of McMillan's. The shaft is 200 feet deep.

Fair prospects in March, 1905, on edge of lead. One cru of—

19½ tons has been reported for 10 dwt. per ton.

Cooke's.—A small crushing early in the year yielded 9¼ d the ton.

Jackson's.—South-east of Greave's. Six men's ground. doned, June.

The shaft is 205 feet deep.

Only colours of gold were found in the wash, and, a trial cru of—

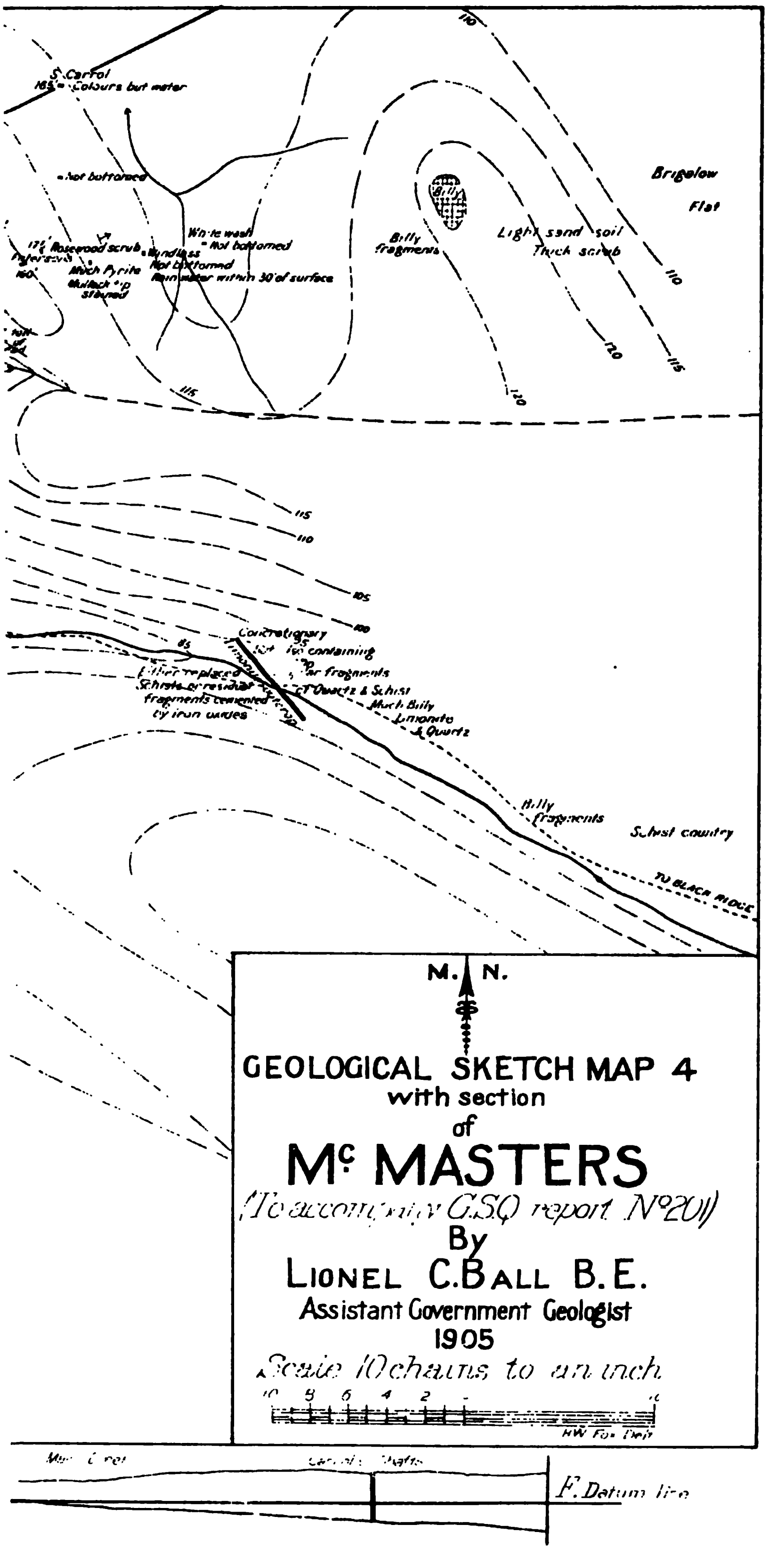
18 tons giving only 4½ dwt. per ton,

the claim was abandoned.

The bottom slopes to the west.

Grace's.—South of Ford's. Six men's ground. Abandoned,

The shaft is 207 feet deep.



GEOLOGICAL SKETCH MAP 4
with section
of
Mc MASTERS
(To accompany G.S.Q. report No 201)
By
LIONEL C.BALL B.E.
Assistant Government Geologist
1905
Scale 10 chains to an inch

IV.—McMASTER'S.

The discovery of surface gold in Prospector's Gully, four miles west of Gowrie Creek (at the Black Ridge) followed that at Hurley's in 1864, but a second "rush" to the deep ground north of the creek took place in 1890, in which year nearly all the deeper shafts were put down. Work was abandoned in the deep ground because of the better prospects obtaining at the Black Ridge, but about twenty-five men are still working in the shallower ground.

1. SURFACING.

The workings in Prospector's Gully are about five chains wide, and, to judge by the immense heaps of tailings, the treatment must have been profitable. The ground in fact was specially rich. (Plate 11.)

On the southern side of the Gully is a 15-ft. cap of "cement," which has necessitated sinking to get at the "wash."

The bedrock exposed in the Gully is slaty quartzite.

Lately a little gold has been got in "surfacing" on the southern side of the ridge at the head of the Gully, near Top Camp. The ground—a decomposed basalt soil with lumps of magnesite—quickly deepens to 20 ft. towards the south-east, and the run of gold has been lost.

2. SINKING.

The gold was traced into the basal bed of conglomerate, here dipping eastwards and differing from that at the Black Ridge only in the absence of granite. The overlying sandstone and carbonaceous shales indicate it to be of Permo-Carboniferous age, and Mr. Dunstan has recorded the occurrence of coal in McMaster's shaft.

The "run" was followed to the east round the ridge, with an average width of two chains. In this part, between Prospector's Gully and the main creek (a distance of 35 chains), men are still at work on untouched blocks of ground, of which there are believed to be a number. The ground is richest where the slate is either on edge or else "jumbled."

The "wash" is broken up in troughs at the claim, and the fines are then bagged for transport to water—at the present time, to the Black Ridge.

Otto's.—On the southern side of the main creek.

The shaft, four chains distant from the Creek, is 65 ft. deep, and from it a gutter, dipping easterly, has been followed for 12 ft. to the north-west.

The "wash" contains much quartz-veined quartzite (which is considered a good indication here) and slate, but very little quartz. The gold occurs in patches separated by barren ground. Most of the gold, which is granular in texture and "shotty" in form, is on the bott and on crevices and joints, running east and west and north and sou in bedrock.

It is considered that most of the gold is saved by taking fr 2 in. to 4 in. of "wash" and bedrock. From the claim on the sou west of Otto's 50 oz. were obtained.

Molloy's (abandoned).—On the alluvial flat on the south side and adjacent to, the main creek.

The shaft is 80 ft. deep.

The gold is stated to have been coarse, ranging in mass up 33 dwt.

For treatment 4 in. of "wash" and 4 in. bottom were raised.

French's (abandoned).—In a similar position to Molloy's, ab four chains to the south.

The shaft is 70 ft. deep.

It is reported that twenty loads from this claim yielded 1 oz. the load.

It is held, and with some reason, that the gold-bearing "run" m yet be proved to continue north-eastwards, from the shallow grou on the southern side of the creek (the claims worked running o slightly north of east). The fact that in Carroll's shaft, 165 ft. de lying 10 chains north of Paterson's, gold-bearing "wash," with mu water, was struck, is strong evidence in favour of the assumpti The slope of the bottom in that shaft is north-eastwards—*i.e.*, mo towards the Seventeen-Mile Well than towards the Black Ridge.

Craven's (abandoned).—North of the creek. This was the n claim towards the dip about which any particulars could be obtain

The shaft is 105 ft. deep.

It is reported that three loads yielded a total of 15 oz.

Copperwell's.—In this, the adjacent claim on the east, t "wash" struck was barren; but pyrite, both massive and crystallis is very abundant in the quartz of the "wash" on the tip.

Wainsboro's (abandoned).—Eight chains east of the creek.

The shaft is 146 ft. deep.

The auriferous portion of the "wash," which was brick-red colour, is said to have been 4 ft. thick in this claim.

Cross's (abandoned).—Two and a-half chains north-east of Wai boro's.

The shaft is 150 ft. deep.

It is said that, in this claim, the bottom sloped towards Pat son's—*i.e.*, to the south-east—pointing to the main run of gold bei in that direction.

Paterson's (abandoned).—On the ridge-top east of the creek.

Paterson's party held this claim for eighteen months. On their abandoning it because of the developments at the Black Ridge, it was taken up by another party, and has since been held by several. The inspection of these workings was rendered possible by the assistance of Mr. Maynard, one of the last to work in it.

There are two main shafts—No. 1 160 ft. deep, and No. 2 (the whip or working shaft 1¼ chains to the east-north-east) 175 ft. deep. Besides these, there is a monkey shaft adjacent to the foot of No. 1 and descending 15 ft. below it. The bottom of the whip and monkey are connected by a semicircular drive, and on the same level a prospecting drive was carried out from the foot of the whip shaft for 70 ft. to the north. At the level of the bottom of No. 1 shaft a large amount of ground has been stoped out, one area extending 30 ft. to the west of that shaft, and another, over a width of 40 ft., to the No. 2 shaft.

The occurrence of efflorescent epsomite, on the strata above the "wash," is very noticeable in descending No. 1 shaft; and at the foot is a large heap of the sulphate and rock powder, which has fretted away from the sides of the shaft. The mullock on the tips also is in an advanced stage of decomposition. Both the crumbling of the rock and the presence of epsomite may be referred to the oxidation of marcasite present in the rock itself.

The "cement" on the lower level is sometimes, at least, tinged red by iron oxides. Only one rich patch of ground, about 25 ft. north of the No. 1 shaft, was struck in this level.

On the upper level the gold was found, three times out of four, above the quartz leaders in the bedrock, and elsewhere along soft thin seams extending for a foot "into the wash," and in places followed for as much as 20 ft. The auriferous ground was very patchy, the best runs being on gentle sidlings.

The fact that, though good gold was found in the "wash" at the top of the "fall" (*see* below) and some gold also at the bottom, the "wash" on its face was barren would indicate that faulting took place either since the gold was deposited in the "wash" or else since the precipitating agent was lodged there.

The gold in the lower workings was coated (probably with iron-manganese oxides), but that in the upper, on the contrary, was quite bright.

The surface of the bottom is very bumpy, though the actual slope, in any direction over large areas, is slight, sometimes scarcely distinguishable in the upper workings; it is to the north-east or north-north-east, and never more than 1 in 8. The general dip in this locality is given as 1 in 11½.

A sudden "fall" of 15 ft. in the bottom can be seen at the monkey and whip shafts, its strike being east-north-east with variations, and its dip 82° to the north-north-west. There is a thickness of several feet of coloured (blue, black, red, brown, and white) bands of cla which, when first opened, gave much trouble owing to its plasticit This has every appearance of a fault plane. All search for any co tinuation of the fault into the "wash" above was futile; but, owir to the originally loose nature of the conglomerate, it is to be expect that the fault would die out in it, a bending taking place instead faulting.

The bedrock (schist) seems when first exposed to have been gent folded and fairly massive, but exposure has caused it to split up in thin folded laminæ. "Hungry" white quartz leaders, often strong ironstained, occur in it, some of them parallel to the foldings of tl rock. (Fig. 6.)

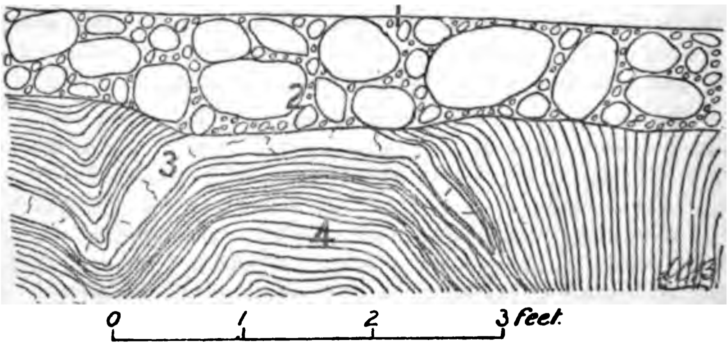


Fig. 6.—Quartz in Schist, Paterson's Claim, McMaster's.

1. Roof of drive. *3. Quartz lens.*
2. "Wash." *4. Schist.*

Otto's (abandoned).—East of Paterson's; the only one of sever shafts that bottomed.

The shaft is 120 (?) ft. deep, and a 40-ft. drive opens out from to the north.

On the southern side of this drive was a high "wall" of bedroc probably produced by faulting.

The "wash" must have contained a large quantity of pyrite, ar yielded five or six pennyweights to the load when worked by Ott though other parties later secured, he informed me, up to an ounce the load.

3. NEIGHBOURING WORKINGS.

SCHNUFFLER'S DAM.

Half a mile west-south-west of Top Camp, and seven miles nort north-west of the Venus Hotel.

The workings, practically all surfacing, are just beneath tl divide between the Burdekin and Fitzroy waters. The country highly altered slate and quartzite.

A few men are here in scattered localities making a living by dr blowing the surface soil.

YANKEE CAMP.

This abandoned ground, which is also known as White Hill, lies, across a black-soil flat about three-quarters of a mile south-east of Top Camp (McMaster's), close to the divide between Bath Creek and Miclere Creek waters.

An east and west line (10 chains long) of surface pits is to be seen at the south, and, from the eastern end, shafts followed northwards a run apparently a chain wide. These are said to have been on good gold for about 10 chains, when, on passing under the black soil (which continues uninteruptedly from here to the Black Ridge), the lead was lost. The Clermont Prospecting Association spent money here in a vain attempt to discover the continuation.

The "wash" consists chiefly of well waterworn quartz, and is remarkable for its freedom from colouring matter. On the surface (the shafts are inaccessible) there is nothing to show the age of the "wash." It differs entirely in general appearance from all conglomerates seen in the coal measures of this district, and looks newer. A similar material is said to have been pierced in sinking Paterson's whip shaft at McMaster's.

It is understood that the gold was found here in association with magnesite. The presence of the magnesite, derived from a former extension of the basalt area, is simply due to its having, owing to its relatively high specific gravity, sunk through the other materials of the soil and "wash."

The bottom slopes northwards, its depth gradually increasing from a few inches to 50 and 60 ft., as proved by the workings.

The bedrock is reported to have been slate containing leaders of quartz.

BLACK JOHNSON'S.

This locality is a little over half a mile west of the Seventeen-Mile Well, and three miles and three-quarters west-north-west of the Ridge.

The present population consists of four men, who are considerably handicapped by the almost continual want of water, that for domestic purposes having to be carried from the Seventeen-Mile Well.

On the left bank of the main creek, which here runs to the north-west, shafts have been sunk 20 ft., in alluvium, to a slate bottom. Away from the creek the ground became gradually shallower, till it was possible to work it by open surfacing. Some of the claims near the creek were profitably held by two or three parties in succession. At the present time the colours found are rather fine, flat, and rounded off, but in the past 5-oz. "specks" have been unearthed.

On the right side of the creek, to the south of the camp, specks of "shotty" gold, up to an ounce in weight, have lately been found by the sole man working there. The gold occurs in shallow trails and patches, chiefly on "bars." "Cement," which here appears to be only residual schist and quartz with occasional waterworn pebbles, continues south-eastwards up a ridge, for about a quarter of a mile, its thickness increasing from 10 to 20 ft. Gold had been found in the last hole sunk, but the ground could not be tested because of the absence of a water supply.

Beyond these workings there is an outcrop of "pudding-stone billy," separating them from the black soil downs beyond.

An isolated area of surfacing, five chains in diameter, lies on a south-eastern slope one mile south-west of Johnson's Camp, the " wash" consisting almost entirely of angular quartz. One or two men are now going over the old blocks, dry-jigging. Gold must have been brought into the rubble, or into the original schists, in solution, for it has been proved that the area is in no way connected with any other auriferous deposit.

SCRUBBY DAM.

In this locality, two miles west of Black Johnson's, numerous shallow shafts have been sunk by the Clermont Prospecting Association, without, however, discovering payable gold.

SEVENTEEN-MILE WELL.

The distance (17 miles) is from Clermont, and the well is adjacent to the main northern road and telegraph line, three miles and a quarter north-westerly of Gowrie Creek (Black Ridge).

The well itself, 75 ft. deep, has not been sunk below the basalt. Further down the creek, there are reported to be several shafts 60 ft. to 90 ft. deep, which, however, were not seen. The surface formation was "billy," below which were found alternating gravel and fine sediments, but schist bedrock was not reached. They prove the extension of the Black Ridge strata in this direction.

Three miles east of the Seventeen-Mile Well (on the Springs-Miclere Road) the base of the solid basalt is given by Dr. Jack* as only 40 ft. from the surface, overlying 100 ft. of soft red clay (which may be decomposed basalt). A second well, a mile further east, showed the following section, according to the same authority:—

Basalt	40 feet
Mundic (?)	
Decomposed basalt (?)	56 feet.

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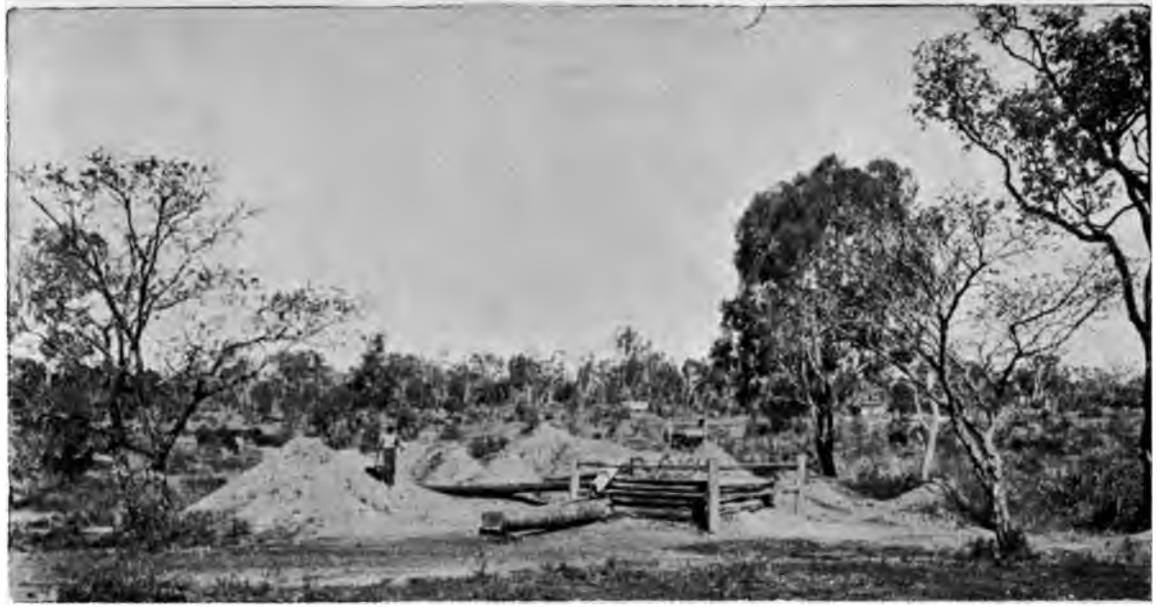
* G.S.Q., No. 103.



Photo, L.C.B.

GOVERNMENT WELL, MICLERE.

WITH TAILINGS HEAPS IN FOREGROUND.

Plate 12.

V.—MICLERE.

The Miclere workings, called so because they are in the gullies and ridges in the vicinity of the creek of that name, lie nine miles north-by-west of the Springs Hotel and 20 miles north-by-west of Clermont.

The discovery of gold here was made in 1865, but the locality was not held of any account till 1871, since when it has continually supported a number of fossickers. In August, 1904, there were reported to be about sixty men in the district, a few having their wives with them.

Black soil (basalt) downs extend from the Springs to the head of the old shallow workings in Coglan's Gully, about a mile and a half south of Miclere Creek, where schists are exposed. These, Mr. Rands states* form an inlier, six miles long and three miles wide, surrounded by basalt.

The price paid by storekeepers for Miclere gold is £3 17s. per oz.

1. UPPER CAMP.

An extensive area has been rooted over along Coglan's Gully (a small tributary of Miclere Creek), and above and below the Gully on the Miclere itself.

"Billy" occurs most plentifully in the "wash," and the same rock occurs in large outcrops in the vicinity.

The Government Well, on the Miclere, is about half a mile above Coglan's Gully. It has, since 1890, facilitated prospecting and washing of prospects, as testified by the heaps of tailings (7 ft. and 8 ft. high and a chain in diameter), which have been accumulated from countless "pannings-off." (*See* Plate 12.)

Old workings extend above the Government Well for about three miles (to the Twelve-Mile Downs), but there are now very few men on the upper parts of the creek. The surfacing shows the gold to have occurred in runs along and across low ridges. In one or two places, in the alluvial on tributary gullies, sinking has been undertaken, but only to a depth of a few feet.

2. MIDDLE CAMP.

The abandoned workings are reported to extend along Miclere Creek, a total distance of six miles, only two and a half miles of which, having been seen by me, are shown on the accompanying plan. (Fig. 7.)

Boulder Hill.—This slight elevation, lying to the west of Coglan's Gully, is capped by "billy" (*see* under "Billy," Appendix IV.). Gold-bearing ground has been opened on the summit, but the best was found on the north-western side, where a little work is still going on.

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* G.S.Q., No. 27.

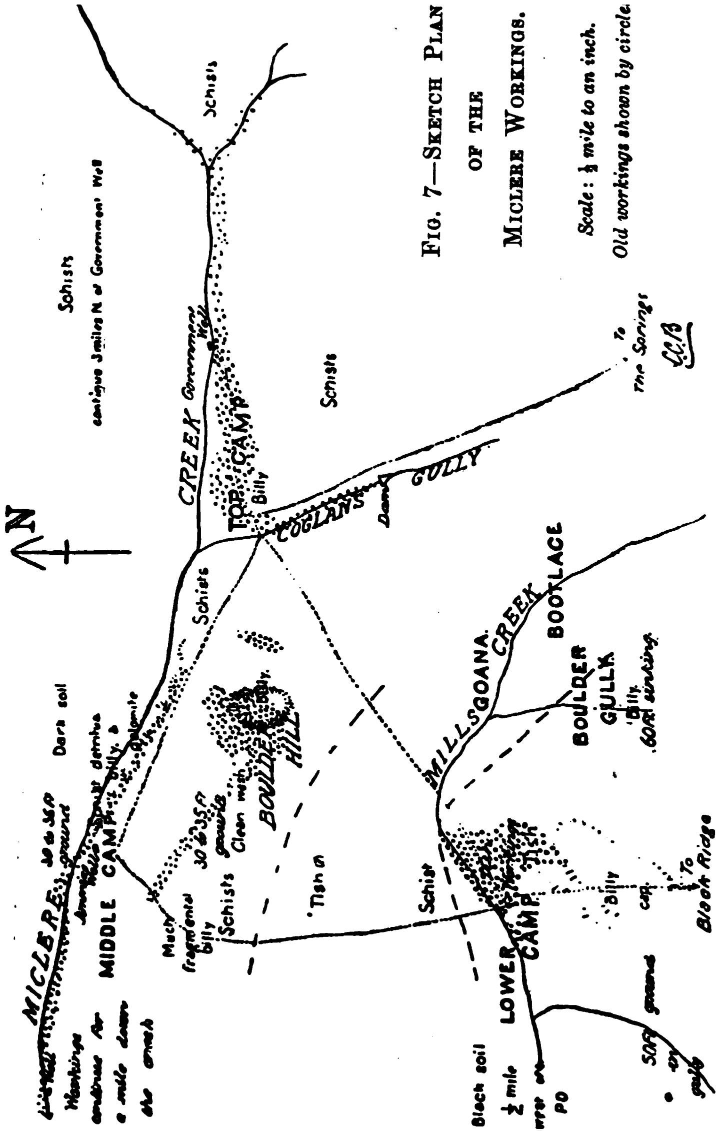

FIG. 7—SKETCH PLAN OF THE MICLERE WORKINGS.

Scale: ½ mile to an inch.
Old workings shown by circle

The "wash" was up to 12 in. thick, and, over much of the area worked, was covered by a cap of "billy" from 3 ft. to 6 ft. thick. It is reported that slugs of gold up to the size of hen's eggs were found here, and something of the kind would be necessary to induce miners to exploit the ground. The characteristic of the gold shown me is its jaggedness.

The present method of treating the "wash" is by means of dry-blower or dry-jigger, but when the ground was first opened these

machines had not been introduced, so that the "wash" had to be carted to water. Extensive trials were made later to puddle the "wash," but it is said that only one pennyweight to the load was saved, which of course did not pay.

From the Hill a narrow lead of "wash," 30 ft. to 35 ft. deep, ran west-north-westwards.

This seems to have been deeper than the ground on Miclere Creek itself.

3. LOWER CAMP.

The workings, at the lower camp on Mill's Creek, about three-quarters of a mile south of Miclere Creek, are of very special interest, as the gold has been traced from residual surface deposits into basal conglomerates (locally known as "tish.") (*See* Fig. 8.) The age of these beds is assumed to be Permo-Carboniferous, because of the occurrence of Glossopteris in similar rocks three miles north of the Miclere.*

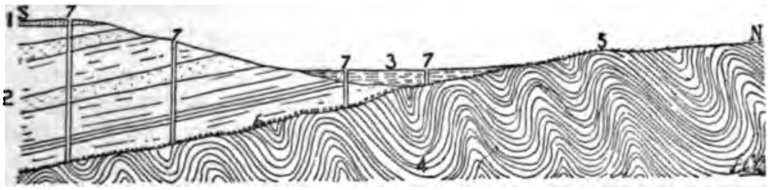

FIG. 8.—DIAGRAMMATIC SECTION, "TISH" WORKINGS, MICLERE.

1. *Billy cap.*
2. *Coal measures (known as "tish" at Miclere.)*
3. *Alluvium.*
4. *Schists.*
5. *Surfacing.*
6. *Gold-bearing "wash" (¼ mile from edge to outcrop of "wash").*
7. *Shafts (deepest 120 ft.) showing sinking—in billy and coal measures, in coal measures, in alluvium and coal measures, and in alluvium.*

The shallow ground north of the coal measures was worked in 1891, the 30 ft. of sinking being through alluvium and residual schist. Brunny's and Collier's claims were the best in this area. (Plate 13.)

Dr. Jack† describes several claims in which the "tish" (consisting of very large close-packed boulders of slate, quartzite, schist, and granite), separating the upper and lower bed of "wash," varied between 4 ft. and 26 ft.

A large amount of work has been done in the conglomerates, the claims and shafts extending from the creek to the ridge top, about a quarter of a mile distant on the south. It is asserted that the ground was quite dry till flooded from the creek, and that the cessation of operations was due to this accident, the miners having no appliances for unwatering the workings. At the present time three claims (old ones) are being worked in the coal measures, but they are near the outcrop—*i.e.*, in 40 ft. ground. It is noticeable that some of the richest claims were, as at the Black Ridge and McMaster's, not on residual ground, but on the conglomerates. It is said that up to 20 oz. to the dish were got in 35 ft. ground, about 20 chains east of the Post Office.

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* G.S.Q., No. 176. B. Dunstan.

† G.S.Q., No. 103.

The majority of the pebbles in the basal conglomerate (the "wash") are spotted schist, the spots being due to the incipient formation of secondary minerals. Both "wash" and bedrock are generally bluish-green. The presence of a thin seam of coal in one of the shafts is recorded by Mr. Dunstan.* There was here no defined channel, but gutters in the bottom, locally known as trails, ran north and south, without, however, any persistency. Patches and shoots of auriferous stone were found irregularly over a width of 100 yards.

The gold, as at the Black Ridge, is rounded when coarse, but flat and often eaten through when fine. Mr. Dunstan* speaks of a sample of gold, adhering to a partly water-worn piece of stone, having been found in these workings, and concludes that it indicates that part of the gold "has been deposited, *in situ*, and therefore subsequent to the formation of this as a sedimentary deposit."

From miners on the field it was learned that taking the whole of the ground treated, 8 in. of "wash" was broken down for an average yield of 15 dwt.

The slope of the bottom towards the south-south-west cannot be much more than 1 in 40.

Smith's and Davis' (originally Taylor's).—Ten chains east of the Post Office.

The shaft is 35 feet deep; the sinking comprised alluvium, to 12 feet depth, and, below that, coal measures. The only workings open to view are the two shafts and a 30-ft. drive connecting them.

The "wash" contains a noticeable proportion of granite. In it "colours" of gold have been found, for as much as two feet from bottom. Most of the gold, however, occurs in crumpled bedrock within six inches of the "wash." A gutter in this crumpled rock, on the south side of a rather persistent leader, is now being followed to the west. The finer particles of gold are flat and granular, the larger rounded (or "shotty"), but even then not solid, and, therefore, said to not weigh well, or, at any rate, not as well as appearances would indicate.

The slope of the bottom, which is not slickensided, is variable (up to 1 in 20), but it is generally to the south.

Bedrock is formed of sandy schist, sometimes, though not often, on edge.

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* G.S.Q., No. 176.

The treatment of the auriferous "wash" consists in breaking it up in troughs with iron-shod beaters; picking out the coarser pebbles by hand; bagging and wheeling the "fines" to the well; and there washing either in a wet-jigger or in a dish.

Madge's (abandoned).—A quarter of a mile south of the outcrop.

A large quantity of biotite-granite is here found in the "wash," together with numerous "pilots." The "wash" differs from that at the Black Ridge only in the greater proportion of granite which it contains, and in the more perfectly rounded condition, more spotted character, and better state of preservation of the boulders, the last of which is probably due to the cementing material. The gold was coarse.

It is reported that the output included—

100 tons, yielding 447 oz. of gold = 4 oz. 9 dwt. 10 gr. per ton,

and the "headings" have been washed and dry-blown over and over again.

Unnamed (abandoned).—Near the ridge top, south of Madge's, and 50 ft. above Mills' Creek.

The shaft is believed to be 120 ft. deep. The deeper part of the sinking must, to judge from the tip, have been in a bed of cemented, angular quartz and schist (such as would be called "tish" at the Black Ridge). Only a few inches of it were auriferous, but four inches of "wash" and four inches of bedrock had to be taken up.

The bedrock is reported to have overhung the "wash," in one place, forming a cliff running about south-east. This was most likely a fault plane.

4. GOANA (ABANDONED).

These workings are on Mills' Creek, half a mile above Lower Camp, the creek itself between the two places being non-auriferous. This place, as well as Bootlace and Boulder Gully, could not be visited in the time allowed me.

5. BOOTLACE (ABANDONED).

Some "surfacings," about a quarter of a mile above Goana, and also on Mills' Creek, are known as Bootlace.

6. BOULDER GULLY (ABANDONED).

Boulder Gully is one of the southern tributaries of Mills' Creek. A small "rush" had lately taken place, but, owing to the immense "billy" boulders on the surface, little work had been done to prove the "wash." The sinking is said to reach a depth of 60 ft.

7th June, 1905.

APPENDICES.

Appendix I.

ALLUVIAL WORKINGS NOT INCLUDED ABOVE.

1. VENUS.

The Venus Hotel, a well-known centre, is situated on the right bank of Bath Creek, 10 miles north-west of Clermont.

I. VENUS FLAT.

Gold was discovered here in 1902, but work has now practically ceased. The ridges and gullies, across the Flat from the hotel, have been worked, and the waterlogged "wash," under the flat in front of the hotel, is believed to contain three or four pennyweights of gold per ton. Some twenty-five years ago a narrow lead was followed westwards for 15 chains behind the hotel, the gold being then lost in "cement" (conglomerate).

The Venus Flat workings, a quarter of a mile wide, pass on to the ridge-side west of the flat about three-quarters of a mile south-east of the hotel. In these is exposed a similar occurrence to that at the Springs and Black Ridge, there being 5 in. of cement-like "wash," which increases in thickness up the ridge-side to the south-west. South of the main area worked on the ridge a narrow lead was followed down a gully to the road, the depth of "wash" gradually increasing. Below this the main lead on the Flat has been followed down for a mile, the sinking rapidly increasing to 40 ft.

Though a large amount of work has been done here, the results are understood to have not been altogether satisfactory.

II. MOUNT WALKER.

A mile north-west of the Venus Hotel.

A narrow east-and-west belt of "tish," on the southern slopes of the mountain, is now being prospected. The sinking is from 15 to 30 ft.

The "tish" consists of large angular boulders of schist, resting on a rough bottom of mica-schist. The gold is very coarse.

III. OLD FOUR-MILE LEAD.

These old workings are a mile and a quarter west-north-west of the Venus Hotel.

The lead was traced southwards, from Commissioners' Flat onto the ridge, where it passed under "cement"—*i.e.*, Permo-Carboniferous conglomerate. The main run was very rich, 70 oz. to the bag having been obtained, but the miners now in the 60 ft. ground are earning only "tucker."

The sinking on the ridge top is 25 ft.; the bottom rolls and the gutters run south-east. Miners, now reworking the old claims, are tearing up 3 in. of the old bottom, the gold in which was overlooked by the men who first held the ground.

This belt of "cement" is believed to continue south-south-eastwards to the Native Bee workings.

Wall's.—One mile west of the Venus Hotel. This is one of the most southerly claims on the Four-Mile Lead.

The shaft, 75 ft. deep, was sunk thirteen years ago.

The "wash" is blue "cement," similar to that at the Black Ridge, and dipping north-east. It requires shooting.

Gold occurs on a "false bottom," and is just as good 2 ft. above as on bottom, the returns varying from "very poor to wages."

Russian's.—About one and a-half miles to the south-south-east of the above.

Shaft is 112 ft. deep.

The "wash" here is poor, but the ground is well worth prospecting.

2. HURLEY'S.

"The cement lead mostly occupies the caps of ridges. . . The hard cement or conglomerate of which it is formed dips at an angle of about 30°, and, although the outcrop has been well worked over, very little has been done below the surface on account of the difficulty in working the deposit. Boulders, tons in weight, occur in it most irregularly, and consist of quartz, quartzite, sandstone, and slate, some of which bear a striking resemblance to the sandstones and quartzites of the "Star" beds of the Drummond Range to the south-west.

"It has not been ascertained to what depth the conglomerate extends. . . . Tests have been made of the conglomerate to ascertain whether battery treatment and amalgamation would be successful, but so far the results have not been sufficiently satisfactory to continue the work. The amount of stone available, which is said to carry a few pennyweights of gold, is enormous, and possibly other methods of treatment might meet with more success."*

It was understood that several men were dry-blowing in this district, but my time limit unfortunately did not allow me to visit the locality. The above quotations are given because of their bearing on the operations at the Black Ridge.

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* G.S.Q., No. 176. B. Dunstan.

3. APSLEY.

At the White Gates, on Apsley Creek, rough surface gold, in waterworn "wash," was found and worked five years ago.

In June, 1904, a small rush took place at a locality on the north side of Apsley Creek, about four miles north-north-west of Clermont. In July, there were about twenty men at work, though in the previous month there had been over sixty, and a few months later the ground was deserted.

The smallness of the yields and the limited width of the auriferous ground, together with the clayey nature of the "wash," were altogether opposed to this proving a payable or permanent run, but, the sub-basalt (?) "wash" to the north of the workings is worthy of further trial.

Besides the P.C., there were seven claims on the east and three claims on the west.

Prospecting Claim.—Four shafts had been sunk, proving the run of gold-bearing ground, two to eight feet wide, to continue east and west (with slight variations from these directions).

The auriferous material consists of angular quartz and schist, embedded in mottled red and grey clay, and is evidently residual from the denudation of the schist country.

An average of 9 in. to 12 in. of "wash" is broken down for treatment. It is believed to carry from ½ oz. to 1 oz. to the load, and is richest where the run is narrowest. The following is the result of treatment:—

2 loads for ½ oz. to the load.
2 loads for 1 oz. to the load (including a 28 dwt. speck).
2 loads for ½ oz. to the load.

No. 3 East.—The following trial has been obtained from this claim:—

2 loads puddled for 13½ dwt. per load (including one 19 dwt. "colour.")

The "wash," being clayey and damp, has to be dried before being broken up. It is, therefore, spread out on the surface and dried by burning brushwood upon it. It can then be readily "troughed," previously to puddling or dry-blowing.

No. 4 East.—Jack and party in this claim got 5 dwt. in prospecting, and puddled:—

2 loads for 2 dwt. to the load, and
2 loads for 3½ dwt. to the load.

Such being unremunerative, the claim was abandoned.

No. 5 East.—

4 loads puddled for 3 dwt. to the load.

No. 7 East.—The shaft is 72 ft. deep.

The "wash" is barren. Bottom dips 1 in 4 to the north. An abandoned shaft, 45 ft. deep, 400 ft. north of this claim, is on true waterworn "wash," which is, however, barren where tested.

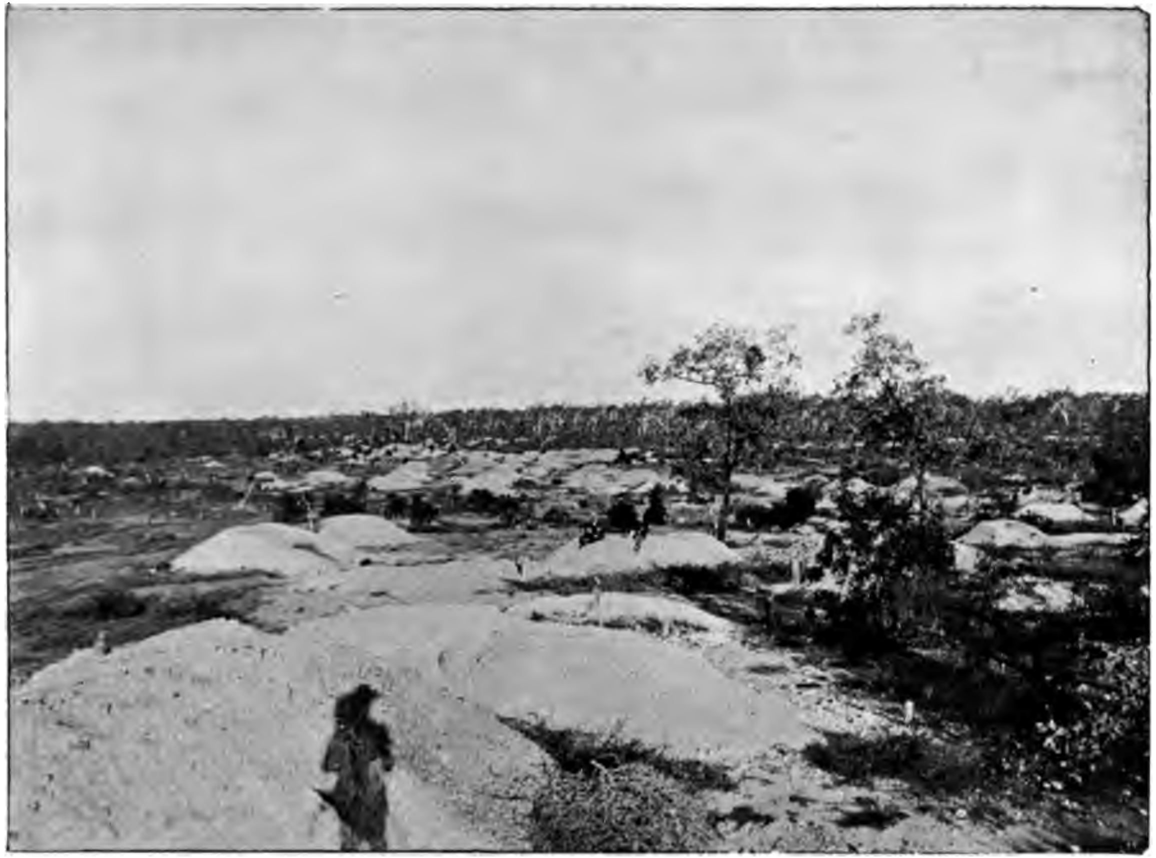

Photo., L.C.B. WILD CAT LEAD, CLERMONT. **Plate 14.**

No. 1 West.—

1 load for 13 dwt.
2 loads for 6½ dwt. per load.

No. 2 West.—

2 loads for 15 dwt. per load.
2 loads for 4 dwt. per load.

4. SEVEN-MILE (COPPERFIELD-ARAMAC ROAD).

The discovery of gold at this spot was reported by C. Voinech (who had been receiving assistance from the Clermont Prospecting Association) early in August, 1904. As shown below, there is here no sign of any lead, the gold derived from quartz leaders in the schist having been simply concentrated in residual *débris*. In consequence, the locality was soon deserted by all except the prospectors, who have since reported finding more promising ground to the north, but the scarcity of water in the vicinity is retarding operations.

Prospecting Claim.—In August, 1904, six shafts had been sunk, the sinking including 15 ft. of angular blocks of schist in clay.

From the main shaft, 32 ft. deep, drives had been carried 5 ft. north and 20 ft. south (to the second shaft), from the former a crosscut running 6 ft. to the west, and from the latter one 12 ft. to the east. From the work done, the auriferous ground seemed to run north-westwards.

The "wash," similar to the sinking, but finer, is 6 in. to 12 in. thick. It contains waterworn gravel, but is a residual deposit. The gold occurs on sidlings, and is irregular in size (up to 3 dwt.), but none of it is "fine."

In August, 1904, a small load yielded 18 dwt. of gold;
In September, 1904, 4 loads were washed for 4 oz. 15 dwt.; and
In October, 1904, 11 loads were washed for 16 oz. 17½ dwt.

Bottom slopes north-west, but is very irregular.

The bedrock is schist.

No. 1 South (Mulholland's).—South-south-west of the P.C.

Bottom was struck at 30 ft. depth, but not a "colour" of gold was found.

Two claims were being worked ahead on the north-east, but had not bottomed.

5. WILD CAT.

The Wild Cat Lead, now almost abandoned, was one of the richest and most continuous in the vicinity of Clermont. It lies just south of the township.

At the time of Mr. Dunstan's visit the shafts were inaccessible, and therefore occasion was taken by me to inspect one now in use.

The result was the observation of faulting of both bedrock and "wash," with apparently most favourable results on the auriferous contents of the latter. (*See* Figs 9, 10, and 11.)

Hopkins' (originally Baker's).—At the junction of the Kitten and Cat Leads.

The present working shaft (A) is 60 ft. deep; two others—(B) 22 yards to the south-south-west, and (C) 47 yards to the south by west—have been sunk on the same north and south "bar"; and a fourth—(D) 85 ft. to the south-south-east—alongside it. These old workings have been reopened, and the "headings" of both the Cat and Kitten "wash" are being broken down for treatment.

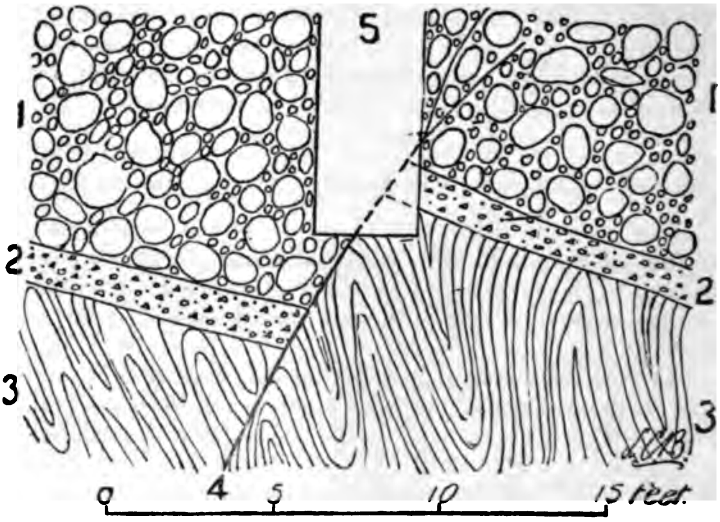

FIG. 9.—SKETCH SECTION, AT SHAFT C, HOPKINS' CLAIM, WILD CAT.

1. Cat "wash" and "headings."
2. Kitten "wash."
3. Schist.
4. Fault in schists, passing into "wash."
5. Shaft C.

Two faults can here be seen, not alone in the schist bottom, but also for 3 ft. above it in the "wash," in which they branch and die out owing to its having yielded to form a monoclinal fold, but, for the distance given, they are strongly marked, vertically slickensided, and manganese-stained. One strikes north-east (on the average), dipping from 45° to 70° to the north-west, the amount of throw varying between 5 ft. and 8 ft. The other strikes north-north-east, and dips up to 80° to the west-north-west, the amount of throw being generally between 2 ft. and 4 ft., but increasing to 8 ft. towards the south. On the fault is a band of sandstone ("sediment"), but enough was not exposed for its nature to be ascertained. The two faults junction at the main shaft, and it is along them and about their intersection that the "wash" has proved richest, enabling more than double the usual thickness to be successfully treated.

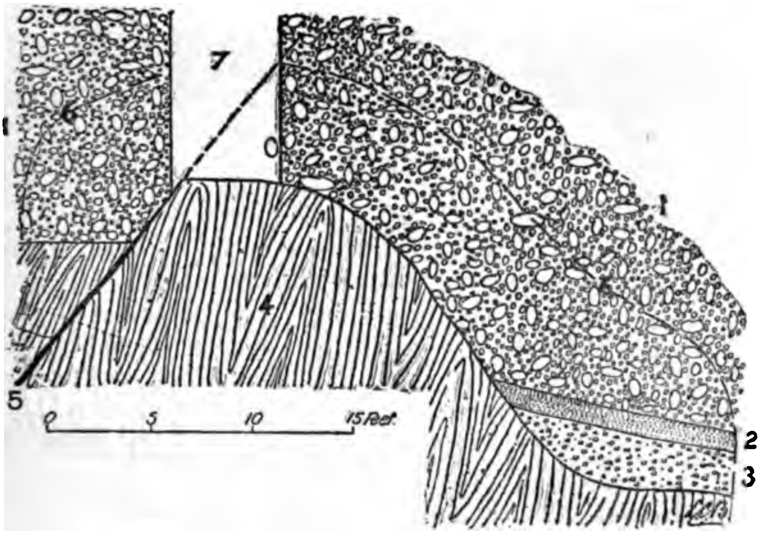

FIG. 10.—SKETCH SECTION AT SHAFT B, HOPKINS' CLAIM, WILD CAT.

1. *Cat "wash" and "headings."*
2. *Sandstone.*
3. *Kitten "wash" (lower half auriferous.)*
4. *Schists.*
5. *Fault in schists, passing into "wash."*
6. *Dotted line, showing roof of workings.*
7. *Shaft B.*

It is important to note that there is said to be an 8 ft. or 9 ft. wall between the Cat Lead (coming from the south), and the Bower Bird Lead (coming from the west), which have been mapped as branches of of the same lead, though some miners who worked in them believe them to be distinct. This "wall" may have been caused either by a washaway or by faulting.

Further, the frequent use of the term "bar" in miners' descriptions of abandoned workings at the Black Ridge, McMaster's, and Miclere acquires an additional importance when it is considered that the "bars" may have been produced by faulting, with considerable effect on the gold contents of the "wash."

Another interesting feature is the occurrence of two distinct layers of auriferous wash—the Kitten Lead, which comes from the south-east, and the Cat Lead, which comes from the south and overlies the former for 100 ft. north of Hopkins' claim.

The "wash" of the Kitten, 2 ft. to 6 ft., and even 15 ft., in thickness, contains big schist floaters, with some rounded quartz, and it generally resembles that known at the Black Ridge as "tish." It may, therefore, be of Permo-Carboniferous age. At Hopkins' shaft (A) the "tish" is overlaid by barren white waterworn gravel.

The auriferous part of the Cat seldom exceeded 3 ft. in thickn in this claim. It consists of waterworn pebbles. The workings or keep closely to the two faults referred to.

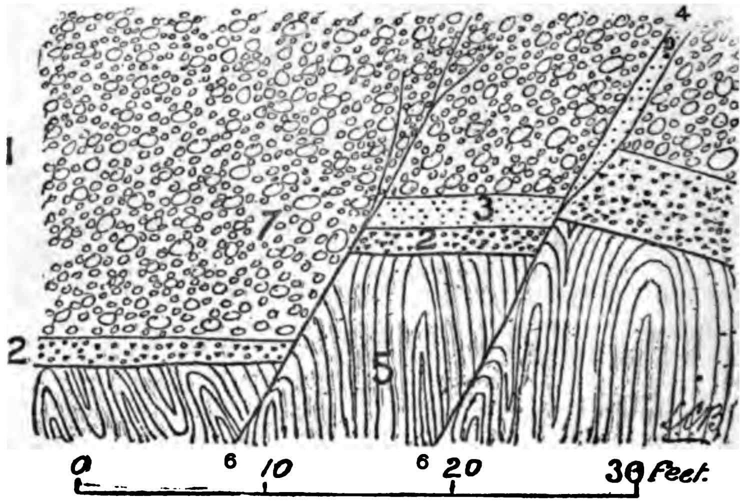

FIG. 11.—SKETCH SECTION ACROSS STEP FAULTS, NEAR SHAFT A, HOPKINS' CLAIM, WILD CAT.

1. *Cat "wash" and "headings."*
2. *Kitten "wash."*
3. *Sandstone.*
4. *Slickensided sandstone.*
5. *Schist.*
6. *Faults in schists, passing into "wash."*
7. *Dotted line, showing extent of workings.*

6. COPPERFIELD.

The township of Copperfield lies four miles south of Clermont.

"Rich patches of gold from a small hill; one man got 100 oz. a foot or two of ground."*

A few dozen men are now working with dry-blowers at scatter points in the vicinity of Copperfield. Several men are dry-jigging t red soil, on the point of a spur, within half a mile and to the nort east of the township. These surface workings are near a number abandoned shafts, in 40 ft. to 50 ft. ground, about which, on a cla known as the Little Wonder, the surface was also exceedingly rich.*

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* G.S.Q., No. 27. William H. Rands.

Appendix II.

REEFING.

(A) North-west of Clermont.

Pioneer.—Ten miles west of Schnuffler's Dam, 14 miles north-west of Blair Athol, and 25 miles north-west of Clermont. This is the P.C. of the Western district. From Mr. Madge, who holds the ground and employs two men on the claim, the following information was obtained:—

There are five parallel reefs within a distance of 600 ft. The northern reefs dip steeply, and have not been tried.

Over a distance of 300 ft. the outcrop of the Pioneer reef has been removed and crushed. The three shafts are 40 ft., 80 ft., and 112 ft. deep, the first two being 35 ft. apart, and the second two 100 ft. apart.

(*a*) 112-ft. shaft.—On the 50-ft. level is a 60-ft. drive to the north, and at 80 ft. depth is another, from which stoping is now being carried upwards.

The reef, in this shaft, varies from nothing up to 10 in. in thickness. It is vertical to 100 ft. depth, but is now slipping off with the country, which is very hard.*

During the first half of 1904—

28 tons were crushed for 2 oz. 3 dwt. per ton.

(*b*) 40-ft. shaft.—This was sunk three years ago. In it the reef passes into the country to the south at 25 ft. depth.

(*c*) 80-ft. shaft.—This is to be used for future exploitation.

Western.—The following information was obtained from Mr. Small, the former holder of the ground:—

The workings lie 600 ft. north of the Pioneer.

The shaft is 80 ft. deep and underlies 45°.

The reef runs a little north of west, and dips south, while the country dips south-west. It pinched at 80 ft. depth, though the walls are still 2 ft. 6 in. apart.

The output is—

12 tons treated at Clermont for a yield of 2 oz. to the ton.

With cartage to Clermont, costing £2 10s., this scarcely paid expenses.

Mount Walker.—About a mile north-west of the Venus Hotel. Near the summit of Mount Walker a leader, underlying west, has been worked to 40 ft. or 50 ft. depth in sandy slate country. The ore was very rich, but the shoot was only the size of the shaft and cut out at the bottom.

Two or three other leaders have been trenched, but nothing permanent has yet been found.

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* Mr. Dunstan describes the rock as felspathic slate.

(B) SOUTH OF CLERMONT.

Skelton's and Whelow's ("New Idea").—Four miles east of Caldwell's battery at Copperfield, and 3½ miles south-south-east of Clermont.

The reef has been trenched for 10 yards, but as it pitched westwards, two windlass shafts had to be sunk about 10 yards apart, the eastern being 51 ft. deep and the western 63 ft. In the latter the shoot was struck at 33 ft. depth. There are drives, 8 ft. west and 12 ft. east, at the bottom of the western shaft; and an 8-ft. drive to the west at the bottom of the eastern.

The average width of the reef, which dips 40 in 1 to the south 10° west, is 3 in., but it generally consists of branches, including schist, so that up to 5 in. are separated for crushing. Leaders, sometimes carrying gold near the reef, pass into the country on the north. The reef is not slickensided, though the footwall breaks away well.

At 60 ft. depth, in the western shaft, a slickensided fault, dipping 40° to west-north-west, throws the leader 4 ft. to the south, but it is understood that quartz continued along the fault. The quartz must therefore be younger than the fault. The stone was especially rich where the leader lay up against the fault. To the east of the fault the quartz gradually thins out, and, in the present face 12 ft. from the shaft, it is only 2 in. thick, though carrying good gold. The difference between the quartz east and west of the fault is probably due to unequal weathering and leaching.

The quartz in the paddock contains plentiful inclusions of schist and siderite on cracks. It appears to be of the usual segregation type characteristic of schist country. The visible gold is all in the form of knife edges and wedges, and occurs in the whitest quartz. Very fine gold also occurs in the siderite. Almost every fragment on the heaps carried visible gold.

The following is the output:—

5 tons (from the trench itself) yielded 7 oz. of gold,

12 tons (from old shaft at western end of trench) yielded 28 oz. gold, one specimen, 1 lb. in weight, yielding 3 oz.

In the western shaft, half a ton of three or four ounce stone was got in the sinking; and 8 lb. of stone, from 60 ft. depth, yielded 24 oz. gold. At the time of my visit the miners were getting good prospects in the western workings. A crushing (including 23 oz. dollied), in August, 1904, of—

8½ tons yielded 108 oz. 2 dwt. = 12 oz. 14 dwt. 8 gr. per ton.

A later crushing in the same year was—

9 tons, yielding 76 oz. = 8 oz. 9 dwt. per ton.

The schist dips 40° to west-north-west.

A shaft, a chain west of the western shaft, struck only small leaderlets in the schist.

Crane's.—Adjoins Skelton's on the north-north-west.

This leader may possibly be a continuation of Skelton's. It has been worked over a distance of a chain, but is now flooded below 15 ft. in the main shaft. A western shaft lies 10 ft., and an eastern 12 ft., from the main one.

In the main shaft, the leader was 6 in. thick to 20 ft. depth, and is reported to be a foot thick thence to 30 ft. depth. In the eastern shaft, the leader is 2 in. thick, but it is increasing westwards and underfoot; and there is also a leader within the hanging-wall. It dips about 85° to the north, while the country dips to the north-north-east. In the bottom of the western shaft is a bluish quartz, probably forming a separate lens to that in the eastern shaft.

Two crushings were obtained from the main shaft—

13 tons for 3½ dwt. gold per ton ; and
5 tons (March, 1904) for 1½ dwt. gold per ton.

Christmas Hill (abandoned).—Two chains north-west of Craven's. This reef was worked twenty-five years ago, and it is said 3-oz. crushings were obtained.

The reef runs east and west, and dips to the north.

Peterson's (Old Mystery).—South of New Idea.

The whole of the ridge-top hereabouts has been trenched and sunk on. The main shaft, about two and a half chains west-south-west of Skelton's, is 15 ft. deep.

The stone, of which 2 tons lie at grass, is whiter than Skelton's.

A second abandoned shaft lies a chain and a-half south-west of the above, on a vertical east and west leader, which has been open-cut for about 40 ft. This is perhaps a branch of the old Victoria reef (worked to the west). In addition to this, several small and not quite parallel leaders have been trenched to 6 ft. or 10 ft. depth.

A chain or two to the south of these workings is a small area of "surfacing," though the soil in the neighbourhood of the known auriferous leaders has not been found worth treating. This indicates the possibility, remote perhaps, of the gold in the surface detritus having been precipitated from solutions derived from the schists, in places where there happened to be no precipitating agents in the schists themselves. It is difficult otherwise to account for the non-coincidence of areas of auriferous surface detritus and auriferous quartz leaders.

Mystery No. 1 West.—This ground was held during 1903, but abandoned in 1904.

The workings include a 43 ft. drive to the east and a 16 ft. drive to the west from the shaft.

An east-north-east and west-south-west slide, at the north-western end of the workings, dips south.

The output comprises—

20 tons for 73 oz., equal to 3 oz. 13 dwt. per ton
12 tons for 18 oz., equal to 1½ oz. per ton.

A lenticular leader north of the Mystery gave a crushing of—

6 tons, yielding 3 oz. total, equal to 10 dwt. per ton.

Callan's.—About four chains west-south-west of the main shaft on the old Sultan, three miles south of Clermont.

The reef strikes west 10° north, and dips northerly at 80°, while the country, reddish chloritic schist, dips about 60° to the south. It thus appears to be a fissure reef; but it is probably on a surface crack only, and not of any permanency. There are here probably several overlapping lenses, which, however, do not extend for more than 1½ chains, judging from surface indications.

The quartz varies from 6 in. to 2 ft. in thickness on the surface. It increases to an average of 18 in. in a trench 10 yards long and 6 ft. deep, and in the western end of the same cuts out. There are also thin veins of quartz in the country beside the main reef.

The quartz is white, but the cracks are iron-stained. On breaking either a pure white or a strongly-stained portion there is emitted a strong fetid odour (due to sulphuretted hydrogen).

Of the ore, 3 or 4 tons lie at the surface.

Bedford's (Whackford and Risien).—South of Macdonald's Flat, four and a half miles south-south-east of Clermont.

A new vertical shaft (3 ft. × 6 ft.) is being sunk, one chain to the west-south-west of the old underlie, and 50 ft. from the cap of the reef, to strike the reef at a depth of about 200 feet. The depth attained, early in August, 1904, was 95 ft (nearing the water-level). The country is slate, with lenticular quartz leaders every 3 ft. or 4 ft. dipping south.

The old shafts were full of water, but have been fully described by Mr. Dunstan, who mentions that a large amount of stone has been taken out and treated, and that on the 50 ft. level from 2 ft. to 6 ft. of the reef has been removed and crushed. "At the 70-ft. level the stone taken out was considered good, but the country is broken and the reef is not defined." Below the water-level no stone has been removed for crushing, but at the bottom the reef is from 5 ft. to 8 ft. thick.

The total crushings, up to September, 1900, were given as—

470 tons, yielding 498 oz. 7 dwt., valued at £1,611 13s. 2d.

with concentrates and cyaniding yielding gold worth £1,183 15s. 3d. Mr. Risien gave me the following additional returns:—

September, 1903: 27 tons 15 cwt. for 27 oz. 2 dwt., valued at £112 5s. 3d.
December, 1901: 100 tons (50 ft. "formation") 21 oz. 10 dwt., valued at £83 7s. 5d.

This "formation" was derived from crosscuts, totalling 51 ft. in length, on the bottom level.

Crown (abandoned).—A mile and a half east-north-east of Copperfield. The reef dips 70° to the south-south-east.

Two shafts have been opened since the mine was last visited. They are about 30 ft. deep, but inaccessible.

At the surface bright yellow micaceous schist, altering in depth to red and blue chloritic schist, is the country.

Palmtree (abandoned).—A quarter of a mile east of the Crown. In a hole a chain and a half east of the deep shaft can be seen about 12 in. to 15 in. of quartz on the hanging-wall, and 15 in. on the foot-wall, separated on the surface by an open fissure (central fissure probably), underlying 70° to the south. The stone looks very promising.

Mundic occurs in stone from the deep shaft, but the quartz there appears to be of the segregation variety. Magnesite seems also to have been met in sinking. A parallel leader has been opened south of the shaft.

Crushings have ranged in yield from 6 dwt. to 17 dwt. per ton. The schist country also dips south, but more steeply than the reef.

Lincoln Leaders.—Two and a half miles south-west of Clermont, on the western side of the Copperfield road.

Several shafts have lately been sunk, but the quartz is not very promising in appearance.

The leaders run east and west, and are vertical or dip to the south.

The schist country strikes north and south, and dips west, but it is much folded and veined with magnesite, derived presumably from a former covering of basalt (as indicated by the occurrence of "billy" boulders on the ridge top, 10 chains to the south).

The reddish soil in the vicinity has lately been receiving attention from dry-blowers.

Star of Hope.—Three-quarters of a mile north-east of the Copperfield copper lode. This has been fully described in Mr. Dunstan's report.

The crushings to 1902 amounted to—

1,030 tons, yielding an average of 15 dwt. per ton.

but a number of additional crushings have been made during the last three years. The last crushing, in February, 1904, was of—

60 tons for a yield of 2 dwt. per ton.

This, it is said, was from abandoned faces, which were known to be poor. Another crushing, in 1904, of—

22 tons gave 8 oz. 10 dwt., equal to 7 dwt. 17 gr. per ton.

(c) SOUTH-WEST OF COPPERFIELD.

Caldwell's.—At the Twelve-mile diggings on Big Ti-tree Gully, Brewery Creek, south-west of Copperfield, 12 miles by road, but only nine miles by track. This was not inspected by me, but Mr. Caldwell supplied the following notes:—

A trench, 12 ft. deep and 16 ft. long, has been cut in the hillside.

The leader is 4 in. to 12 in. thick, and runs east and west from slate into diorite, crossing a dyke of felsite.

The stone was poor in gold in the slate, but rich in the diorite, especially near a 9-in. fault, 1 ft. from the felsite dyke.

In August, 1904, the following crushing was reported—

9 tons gave 12 oz. 4 dwt., equal to 1 oz. 7 dwt. per ton,

but the Warden gives the total for 1904 as—

8½ tons crushed for 48 oz. 11 dwt., equal to 5 oz. 14 dwt. 5 gr. per ton.

Appendix III.

COAL-MINING.

A full report on the Blair Athol Coalfield* has already been published, and the following notes may be taken as supplementary to it, the work here referred to having been done since that report appeared.

FEDERAL COLLIERY.

The Federal Lease is situated on what was originally part of the Carriers' Reserve, on the washpool, Blair Athol, 11½ miles north-west of Clermont.

The main shaft, 60 ft. deep, was sunk in 1898. The method of working is shown in the attached diagram. (Fig. 12.) From a main heading to the east, bords, 10 yards wide and 6 yards apart, run to the north; a second heading runs east and west, at 40 yards from the shaft, and from it stalls are being opened north and south. The coal requires to be blasted down.

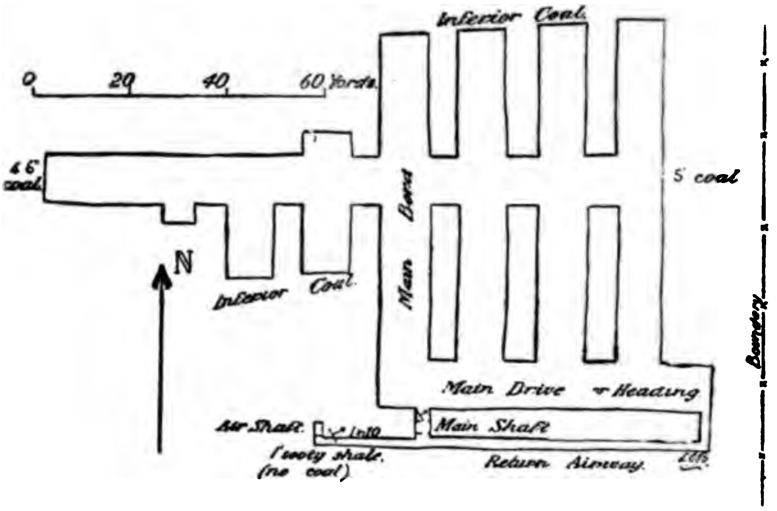

FIG. 12.—SKETCH PLAN, FEDERAL COLLIERY, BLAIR ATHOL.

Scale: 40 yds. to an inch.

The seam averages nearly 5 ft. in thickness, but thin layers of shale appear occasionally 15 in. from the roof. In the present working face, north-west of the main shaft, there is 4 ft. 6 in. of coal, with a 6 in. coaly band above.

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* "The Permo-Carboniferous Coal Measures of Clermont and Associated Formation." By B. Dunstan, F.G.S., Assistant Government Geologist, Brisbane. By Authority: 1900. G.S.Q., No 148.

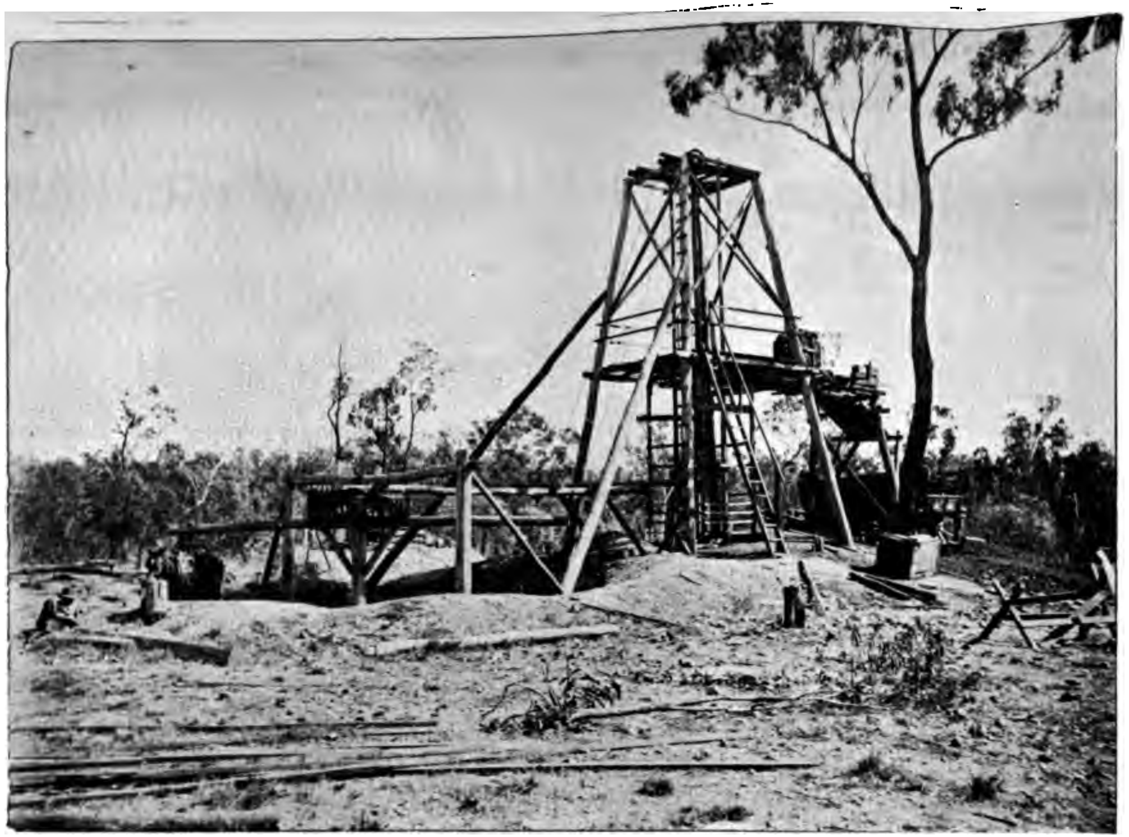

Photo., L.C.B. FEDERAL COLLIERY, BLAIR ATHOL. **Plate 15.**

Though normal in appearance at the main shaft, the coal immediately west of it begins to deteriorate and thin out, and at the air shaft, 24 yards distant, there is only a foot of sooty shale, dipping 1 in 10 to the north-east. A borehole 400 or 500 yards to the west proved the seam to be altogether absent, but a lower one, 27 feet thick and of good quality, was cut at a depth of 80 feet.

A peculiar feature of the seam worked is the east-north-east striking zones of inferior coal, which, it has been noticed, correspond with rolls in the floor, rising about 18 in. above the general level. This deterioration may be due to incipient faulting in the roof, allowing volatile constituents to escape, the swelling of the floor having taken place as a result of the decreased pressure. This inferior coal is very friable, but "burns like sawdust" on an open fire. The zones are locally known as "faults," though no actual faulting can be seen.

A 12-in. band of turgite occurs directly over the coal in one place, and seems to be several yards in diameter. Another lenticular bed, 50 yards in diameter, was found in the Imbil.

The output for the previous three months had been 50 tons a week. The *personnel* consists of manager, two miners, and a whim boy. Six teams are kept going between the colliery and Clermont, the distance by road being 13 miles. The output for the year 1904 was 4,773 tons, valued at 15s. 10d. per ton; and the total to August, 1904, was 7,813 tons, valued at 16s. per ton. This was part of a contract with the Railway Department for 10,000 tons, which has since been completed.

IMBIL COLLIERY.

Coal was last raised about three years ago, but a new shaft has just been sunk to coal. The hauling at both old and new shafts is done by whim.

In the old shaft the bottom of the top seam is at 60 ft. depth, but the new shaft, five chains distant to the north-west, is 90 ft. deep, and proved 4 ft. 6 in. of coal. A drive from the old shaft reaches within 20 yards of the new, and, in the face there, the coal is 6 ft. thick, though the average thickness in the old workings was 3 ft. 11 in. The little air shaft, near the old main shaft, was continued 9 ft. into the bottom seam.

The dip of the strata between the old and new shafts is 1 in 11 to the north 15° east.

HOPE AND ELDORADO COLLIERIES.

These collieries, both of which were provided with winding engines, have been idle, the Hope during the last six years and the Eldorado for the last two years.

Appendix IV.

NOTES ON ROCKS.

No work has yet been done on the specimens collected while the district, owing to the pressure of routine work. It is, howe hoped that supplementary notes may be issued later, giving m information about the geology of the country inspected and petrology of the rocks collected.

BILLY.

Outcrops of billy were noticed at all the localities mentione the body of this report, specially large ones being found at the Spri Black Ridge, McMaster's, Seventeen-mile Well, and Miclere, as as less important ones at Yankee Camp and Black Johnson's.

At all these places the "billy" occurs either on the edge of black soil plains or in the immediate vicinity of such.

Black Ridge.—The best-known outcrop is at Daintree's Knob. has here in places a sintery appearance, especially when the boulde are coated with ironstone externally. The hard white billy quick becomes brown exteriorly, on weathering. Much soft billy is found, well as hard conchoidal; while beneath the solid "billy" is often hollow space or else only partially cemented sand, known as billy san

"Billy" is understood to have been met, in sinking near Gowri Creek, between the head of the creek and the Billiard-room. The be extends northwards from Daintree's Knob beneath the surface, crossin the creek to the eastern side near the Bakery (where 20 ft. thick) and again crossing to the western side at Noonan's Store, after sweeping round the Old Cricket Ground, when it runs up the Old Puddle Gully to appear near Moxhan's Leap as a considerable "blow."

Seventeen-mile Well.—A billy blow, running south-east, was see about 10 chains south of the crossing of the main Northern an Miclere-McMaster's roads.

Angular quartz billy forms a knoll, four chains in diameter an rising to 20 ft. above the surrounding plain, 30 chains north of th Seventeen-mile Well. There is chocolate soil on the north and blac on all other sides of this outcrop.

Again, a little over a quarter of a mile to the south-east of th Well, a strip of billy, 15 chains in length and one chain wide, run parallel to the Northern road, and adjoins the black soil downs.

McMaster's.—A large "blow" occurs about three miles west of th Ridge, rising 10 ft. above the adjacent black soil flat. Generally i consists chiefly of angular fragments of quartz, though at times th angular fragments are absent, and then a few rounded grains are to b seen. It has the appearance of a re-cemented residual schist deposi

Billy outcrops occur north of the workings at McMaster's, and also east (towards the Ridge), there being large outcrops, probably 10 chains in diameter and up to 3 ft. thick, of both dense conchoidal and sandy cavernous rock on the edge of black soil. Quartz fragments in the billy are not properly rounded, and the sand is sharp.

Miclere.—Boulder Hill, a quarter of a mile south of Miclere Creek, and about half a mile west of its tributary, Coglan's Gully, is capped by one of the largest deposits of billy seen in the district. On the hilltop the billy cap is 2 ft. to 5 ft. thick, and 5 chains long by 2 chains wide. Gold has been worked between the billy and a soft clay bottom, and it is reported by Mr. Dunstan to occur in the billy itself.*

The billy, moreover, consists of angular quartz and schist fragments, ½ in. to 3 in. in diameter, cemented with a brownish-yellow siliceous paste. There is no doubt as to the angular nature of the quartz fragments; only one or two pebbles with edges even worn off were seen out of thousands, the quartz having exactly the appearance of that now shed by veinlets in schists. Angular fragments can be seen not alone in the billy, but also weathering out of it.

The billy here, as a whole, is much more impure than that seen elsewhere. It contains much schist, and the cementing material is almost always coloured grey or yellow, probably because originally clayey and ferruginous.

On the northern slope of the hill, the "billy" forms a cap, 3 ft. thick, resting directly on decomposed clay-slates, and, in section, has just the structure of residual soil, with bands of quartz fragments.

Billy caps the ridge south of the "tish" workings at the Lower Camp. It consists of the dense conchoidal variety, overlying billy sand—*i.e.*, sand only partly cemented by silica.

Billy is reported to occur on the left side of Miclere Creek, at the Twenty-two Mile, on the telegraph line, three miles below the Diggings.

Blair Athol.—About five chains north of the washpool crossing, on the Coal Mines road, and on the western edge of the black soil is an outcrop, 5 chains long and ½ chain to 2 chains wide. It consists of billy associated with magnesite.

"CLINKER."

"Clinker" is of two kinds, both being products of the decomposition of basalt. The first, sometimes referred to as limestone, and most typically developed at Limestone Hill, near the All Nations Hotel, is magnesic calcium carbonate. It is generally found in irregularly shaped masses of a grey colour and porcellanous texture, though at Limestone Hill it forms a solid bed above the schists. It seems to have been deposited beneath the flow, from which it was derived, and its occurrence on a black soil plain is held by experienced miners to be a certain sign of shallow sinking to schist or coal measures. T second kind is chalcedonic and dendriform, sometimes pink, but mo often earthy-grey. It also occurs in black soil, but may not necessar be a sign of the proximity of bedrock. It occurs in some quant near the Northern road, north-west of Blair Athol Leasehold.

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* G.S.Q., 176.

GRANITE.

With regard to the source of the granite boulders in the "was the nearest outcrop of muscovite-granite, such as that found in "basalt lead" at Clermont, is reported to be at Douglas Creek, miles to the south, but there may of course be unexposed dykes of rock much nearer.

"PILOTSTONE."

Pilots are the heavy black boulders of quartz and tourmaline rock, generally found where the gold is richest in the "wash."

Pilotstone, found *in situ*, was shown me by Mr. McDougall, f the junction of granite and slate, half a mile below Peak Vale Stati

COAL.

The occurrence of coal in the gold shafts in the vicinity of Springs and Black Ridge has been recorded at Appleton's, on L later's Lead; at the coal shafts, on Spring's Creek; at an abando claim, on Daintree's Knob; at Mason's and Pengelly's claims, Bl Ridge; and at an abandoned claim, Miclere. The seams are small, and none of them were exposed when I was present.

Appendix V.

REFERENCES TO NUMBERS ON MAPS.

1. Beside the main northern road, near the creek, 1½ miles north-west of the Blair Athol leasehold. An outcrop of basalt, in large blocks.

2. Just east of Note 1. The soil is brownish, and contains a considerable amount of fragmental quartz, indicating that the schists are at no great depth.

3. The downs about ¼ mile north of the Old Cricket Ground. Occasional fragments of quartz are found in the black soil, showing that the schists continue north-westwards from the P.C.

4. Gowrie Creek, 5 chains north of the P.C. A pothole exposes 2 ft. 6 in. black soil over 2 ft. 6 in. brown soil on pink schist.

5. On Gowrie Creek, north-north-eastwards of the P.C. The surfacing at the creek consisted simply in removing 6 in. soil, but southwards the depth gradually increased.

6. Below the workings, but still on same side of Gowrie Creek. The soil contains quartz, but also much ironstone (limonite) gravel, and being brownish, was probably formerly covered by basalt, which it is probable extended southwards over Cumberland Lead and past Flyspeck, round Hard Hill to the open downs.

7. Gowrie Creek, half-way between Noonan's and the Puddlers. Top end of a deep breakaway in the banks of the creek, exposing 5 ft. dark soil above 2 ft. red clay, with angular quartz fragments, probably a residual schist.

8. Shaft on the northern bank of the creek, just below Note 7. In it 10 ft. black soil can be seen overlying a lighter material. The shaft bottomed in a brown micaceous schist.

9. The "Point" of the Black Ridge. In 10 to 14 ft. ground here it is reported 5 dwt. to the bag was obtained on washing.

10. South of Note 9, there was a poor patch, yielding only 4 or 5 dwt. per load.

11. The outcrop of the conglomerate on the eastern side of the Black Ridge, near Flyspeck. The best returns (30 dwt. to 4 oz. per load) were not obtained in surfacing, but in the shallow sinking in the conglomerate.

12. Half-way down Cumberland Lead. Residual clay, known locally as fireclay, with a strong saline taste, is exposed in the workings.

13. Hereabouts is a fall from 3 to 9 ft. depth. Two trails were followed a short distance, in the northern one the gold occuring at 8 ft. depth on "fireclay." In the other a few feet wide, the depth was less, but gold occurred from surface to bottom.

14. Stevensen's shaft. The sinking consisted of 40 ft. of "fireclay," resting on a decomposed clayslate bottom.

15. In the shafts south of Stevensen's 28 to 30 ft. of fireclay was proved.

16. Lewis' shaft. Sinking was in part in basalt.

17. Strong red soil (decomposed basalt (?)) with quartz pebbles.

18. Red shaft, 91 ft., south of the unworked ground. Fine gold, 10 to 12 dwt. to the load, ran in a trail down the slope to the west.

19. Meyer's: Shaft 104 ft. deep. Blue "wash," barren of gold. Bedrock chloritic slate.

20. Moxham's Leap "billy" outcrop. Occasional fragments of billy sandstone occur beyond the limit of the solid outcrop.

21. Continuation of the southern arm of the billy is probable, below the soil.

22. Billy occurs in patches under the flat north of the Old Cricket Ground.

23. Windlass well south-west of the Billiard Room. Reported that the wash carried only 2 dwt. to the load.

24. North of Daintree's Knob. Billy occurs beneath the flat in some of the shafts, 19 ft. in thickness, the upper 10 or 11 ft. being very dense and hard, the lower perhaps quite loose, and sometimes having a cavity beneath the harder cap.

25. Shaft south of McDonald's, Daintree's Knob. Gold occurred on a false bottom, the yields being from 1 to 5½ oz. to the load.

26. West of Daintree's Knob. Billy was met in sinking for a couple of chains west of the outcrop, though not seen on the surface.

27. Burn's, Daintree's Knob. Shaft 138 ft. deep; now used as a well; 6-in. wash and 3-in. bottom. Little gold.

28. 96-ft. shaft west of Davis' claim, Daintree's Knob. 4 oz. to the load. Pugh's, east of Daintree's Knob. Headings are being dry-blown.

29. Outside shaft (120 ft. deep), Daintree's Knob. In this shaft no gold was found, but no driving was done to prospect the ground.

30. In an abandoned claim, about 5 chains east of Davis', the wash is reported to have yielded 7 or 8 dwt. per load for a year. Coaly shale occurred near bottom.

32. Shaft near billy blow, on road south-west of Hard Hill. Sinking carbonaceous and pyritous shale over wash resting on a white siliceous slate.

33. Pothole proves fireclay over wash at 12 ft. depth.

34. Pothole proves 10 ft. decomposed basalt over quartz pebbles.

35. Shaft bottomed on schist shows 3 ft. surface pebbles over 10 ft. decomposed basalt.

36. South-east extremity of Hard Hill. Light soil, presumably schist, but shows much rounded quartz, perhaps residual from the conglomerates on the hill above. A few prospecting holes show clay with sintery lime formed from a former covering of basalt. In that case the basalt area should be shown extending almost up to Smith's workings, north-east of Hard Hill.

38. Possibly basalt beneath light surface soil.

39. Shaft on the south-eastern side of Pink Hill. Gold at 30 ft. on a false bottom, schist at 40 ft.

40. On top of Pewt's Hill there are no shafts owing to the hard bottom.

41. McFayden's claim was at the bend of the lead. His was practically the only payable ground.

42. Limestone Hill. Gold occurs in 6 to 12 in. surface soil with loose blocks of "clinker" on solid "clinker" floor.

43. 20 ft. shaft on Cement Hill. Wash occurred under "tish."

Shaft on Gowrie Creek above the Springs Hotel. Exposed 7 ft. black soil over 3 ft. of wash lying on a brown schist. Only the lower foot of the wash is payable auriferous.

44. Brown's adit, Cement Hill. Sandstone bottom dips 1 in 5 to the south.

45. Shaft sunk in grey conglomerate of schist and quartz pebbles.

46. South-east side Cement Hill. 10 ft. surfacing on schist bottom (reported).

47. Reported to be 10 ft. black soil and basalt, and 2 ft. "tish" on a schist bottom.

48. Springs Hotel Well. Sinking included 40 ft. basalt and "fireclay" and bottomed on "tish." A drive was then carried 30 ft. south to the base of the basalt, where a strong supply of water was obtained. It proves that the side of the old valley south of Cement Hill sloped steeply (1 ft. in 1½ ft.) to the southwards.

49. At Burnt School, on Springs Creek. The few rounded quartz pebbles are either drift or residual from a former capping of coal measures, for the schist outcrops in the creek.

50. Craven's. Sinking conglomerate, carbonaceous shale and "tish." Coal is reported to have been cut in this shaft just over the auriferous "wash" at 80 ft. depth. The bottom is a brown slaty schist.

51. 10 ft. shaft. Loose wash dipping 20° to north-east.

52. Shales from these shafts are rich in fossil leaves.

53. Quarry on Ti-tree Creek. Basalt exposed decomposing towards the surface into light kaolin.

II.—SUPPLEMENTARY NOTES

ON THE

BLACK RIDGE, CLERMONT.

By LIONEL C. BALL, B.E.,
ASSISTANT GOVERNMENT GEOLOGIST.

WITH 7 FIGURES AND 6 PLATES.

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MAPS.

See Maps attached to first report, which have been brought up to date.

Supplementary Notes on the Black Ridge

(CLERMONT).

The following notes, made during a brief visit to the Black Ridge in September, 1905, may be taken as supplementary to the foregoing report.

I. GEOLOGY.

1. Faulting.

Further observation was made of faulting of both wash and bedrock. (*See* under descriptions of "Edward's and Ford's," "Last Chance," and "Rejected.")

2. Gold off Bedrock.

The occurrence was noted, in several parts of the Deep Ground, of richer wash many inches and even feet above bedrock, the wash on bottom being comparatively poor. (*See* "Pengelly's and Young's," "Pumpkins," &c.) This is important as showing the need for more careful prospecting of the "headings," the general practice hitherto having been to test only the lower foot of wash, which may in cases be almost barren, while that above may be rich.

3. Supra-basal Beds.

The existence in one or two claims of distinct layers of auriferous wash many feet above the basal beds is reported. ("Just-in-Time No. 2," and "Rejected.") In the same locality an extensive fault occurs, and it is possible that, the lowermost bed being unfavourable for precipitation, the gold was carried in solution to the upper beds. This would indicate the need for re-examination of the headings and upper layers of wash in those claims in which the basal wash has proved poor, especially where extensive faulting is known to have taken place (as in the "Endearer").

4. "Tish."

Deposits of tish beneath the wash have been found in some of the claims above the true bottom. (*See* "Just-in-Time," "Rejected," "Eclipse," &c.) As to its origin, I can offer no other explanation than that it consists of portions of the schist bedrock torn off and shattered by movement of the overlying coal measures.

5. PRECIPITATION OF GOLD.

It must be acknowledged that there is more probability of p cipitation of the gold from solution by carbonaceous matter than evident at the time of my last visit. It will be found that carbonace shale occurs in the wash within a few feet of bottom in all the clai (with the possible exception of the "Just-in-Time") in which payal wash has been found, and that, as far as known, it is absent in t "duffer" ground.

6. SUBTERRANEAN CONTOURS.

Additional details were secured as to the contour of th "bottom"—*i.e.*, the surface separating "wash" (the basal bed of th coal measures) and bedrock (schists). A consideration of these show that a subterranean valley or flat depression extends from Daintree Knob north-north-westwards, and that a branch from the south-wes enters it near the "Pumpkins" and "Bantam," on the Deep Ground This depression appears to open out into a north-east and south-wes valley at the "Contract," but the evidence of this is not yet conclusive

If the "wash" lay in a lead, it would be necessary only to sink on the line of this depression to get the pay wash. It has, however already been indicated that the deposits show none of the characteristics of a fossil river. The auriferous ground has been followed south-westwards from the Old Cricket Ground to the Deep Ground obliquel down the side of the depression, and in the Deep Ground the working extend right across the bottom of the valley to the opposite slope Similarly, the old Red Ground workings are on the northern slope o the depression, and may yet be proved to cross it.

7. "RUNS."

It has been noted that working faces are not carried right throug the claims, for the gold occurs in a number of distinct "runs," with, i is believed, a general east and west trend, though they are not alway parallel, and in one case, in McGillivray's old claim, intersected. Thes "runs" of richer gold-bearing wash have no connection with th contour of the bottom beyond that they are seldom, if ever, found o very steep sidlings.

On the Old Cricket Ground the runs seemed, but not always, t have a south-westerly trend. In the Deep Ground they lie east an west and west-north-westerly. Thus, McGillivray is working tw distinct runs, the northern having been traced between Mason's an the "Fraud" from the bakery on Gowrie Creek. It is believed tha the "Eldorado" and "Just-in-Time," and probably the "Last Chance," are working a different run from that in the adjacent "Hope" an "Bantam"; "McLoskey's Mistake" and "Pumpkins" are on another

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and the "Just-in-Time No. 2," "Rejected," and "Eclipse" may be on still another. There is in consequence a possibility of runs being found between the "Pumpkins" and "Last Chance" and "Eclipse" and "Endearer"; but, further out, it can only be said that prospecting for east and west runs would have most chance of success.

8. WATER.

The water at the Ridge, it may now be taken as proved, occurs in the basalt (generally the vesicular portions) in distinct reservoirs having little or no connection with one another. Station managers now also recognise that wells on the Downs yield sufficient supply for only a limited number of stock.

Practically all the trouble on the Deep Ground has been occasioned by the water occurring between a depth of 95 feet and the base of the basalt. It amounted in one shaft (the "Perseverance") to 2,000 gallons an hour. The water contains considerable salts in solution, but is rendered beautifully soft by boiling, whence it would appear that its hardness is due to carbonate of lime in a carbonic acid solution. A boiler, believed to be sound, soon, if using the water, shows signs of leakage on the joints—viz., incrustations and stalactites of white salts, in which the presence of sodium chloride may be detected by the taste. Boilers are, by the use of the water, rendered quite clean of scale, the deposit being loose and pulverulent.

II. MINING AND MILLING.

1. PROSPECTING.

Gold has been found in the basal conglomerates as far to the south-east as the Springs Hotel (3 miles distant); and in similar beds at the Venus (5 miles to the south-west), at McMaster's (4 miles to the west), and at the Miclere (9 miles to the north). The coal measures have been proved to continue north-westwards from the Black Ridge, but, except at "Chadwick's" (a mile to the north), the basal beds have nowhere been exposed and tried between the Ridge and Miclere. It is therefore evident that the beds should be prospected between the proved auriferous localities.

Very little more is to be expected of the miners, who, with little or no capital, have done a large amount of unproductive work. In addition to the extensive workings in the shallower ground, they have sunk, to the north of the richest line of claims on the Deep Ground, a dozen shafts, to depths of about 250 feet, in hard country, and at the same time they have had to contend with an inflow of water. The sinking of each of these shafts requires three months' labour of six men, and entails an outlay of from £10 to £16 per man for claim expenses. The Mines Department has assisted in the sinking of three of the shafts (the "Endearer," "Last Chance," and "Neiht's"), to the extent £1 per £1 of the cost of the sinking beyond a depth of 100 feet fr the surface.

The only rational way of prospecting the ground is by drilling, which, however, the whole cost would fall on the Government. Min are prepared to sink shafts ahead if assisted financially; one party (the "Bottletree") has, in fact, already without assistance sunk a sh to water-level (at about 100 feet depth), 3 miles north of the Bla Ridge.

The latest proposal is that of the Black Ridge Progress Associ tion. It is for parties of miners to sink two shafts (quarter of a mil ahead of the claims on gold), assisted by a Government subsidy at th rate of £1 for £1 expended, the amount so received to be repaid out o profits, if any. If only two shafts were to be sunk, one of them should be located about a quarter of a mile north-west of Fraser's battery, the other a like distance north-west of the "Pumpkins," thus bringing the shafts within a quarter of a mile of one another. Alternatively to the latter, a shaft might be sunk about a quarter of a mile north of "Pengelly's and Young's." My reasons for chosing these sites are that the general run of the auriferous belt has been north-westwards from the Springs Hotel, and there appear to be alternate rich and poor areas crossing the belt, on east and west lines. If such is the case, the proposed shafts may be in auriferous ground, but in any case the locality would have to be tested sooner or later.

There were believed to be, in September last, some 300 men on the field, a considerable proportion of whom had their families with them, and for their future maintenance further developments must take place.

The output, September, 1905, of the Black Ridge (mostly from the Deep Ground) was 687 oz., valued at £2,750, the greater part of which, it is held, is spent locally and in the development of the claims.

2. SINKING.

To sink through the water-bearing rock it is necessary, when the water is heavy, and advisable in any case, to "pug" it back. The only method hitherto tried at the Ridge with success is the following:—The shaft is first carried through the water-bearing stratum, and is then enlarged in that stratum, to allow of heavy (8 in. diameter) timber frames being fitted in with 6 to 9 in. or more of clay packing behind them. (*See* Fig. 1.) The apparently more effective method of sinking the shaft only sufficiently to insert one frame at a time has failed, because of the difficulty of keeping the clay in place; but the use of a binding material, such as straw, hair, cocoanut fibre, or moss should obviate this difficulty. Auger holes are bored in the frames when in place, and plugs of dried clay are driven in until the mass of clay behind has been driven into every crack, forming a firm and impervious wall.

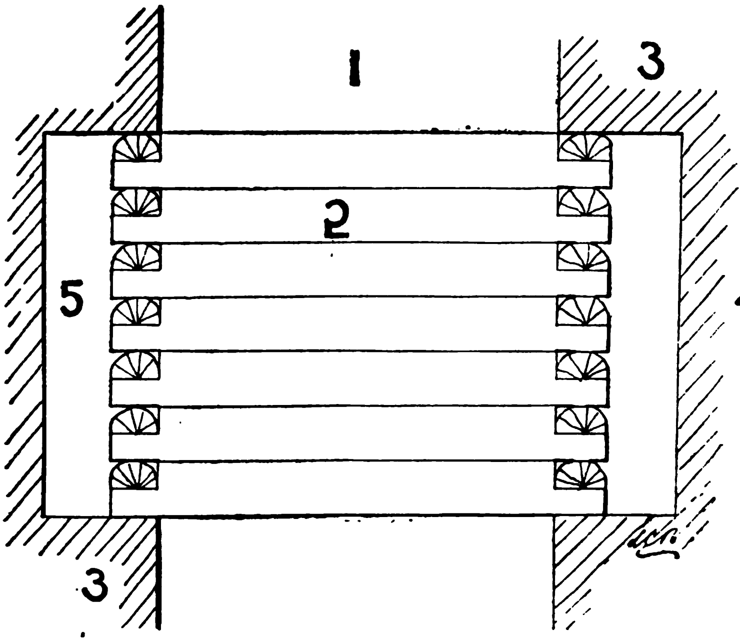

FIG. 1.—METHOD OF "PUGGING BACK" WATER.

Scale: 30 ft. to an inch

1. Shaft.
2. Round timber.
3. Impervious rock.
4. Pervious rock—water-bearing stratum.
5. Pug.

The water has had to be raised in buckets while this work was being carried out, and in several instances it has been found impossible to keep the water in the shaft low enough to allow the sinking to go on. The Government has, therefore, undertaken to supply a pump and boiler, at a rental of £1 per week. This will enable the pugging back to be carried out rapidly in each shaft, but it is not expected to have any great effect on the waterlogged condition of the ground in the adjoining claims. As mentioned, it is the water in the basalt that has occasioned the trouble in sinking, the comparatively small quantity yet met in the "cement" being quite under the control of the miners.

3. EXPLOITATION.

It is becoming the practice on the Deep Ground to work as much as possible in the bedrock because of its relative softness. To break down the wash a bench is carried beneath it, and, in prospecting, drives are often carried almost entirely in schist. This procedure has two defects: Firstly, considerable values must be lost in the packing, especially in the richer ground, by what is practically overhand stoping; and, secondly, by driving in bedrock the wash is insufficiently prospected.

A face is carried along in the direction of the run of the richest gold, as found by panning off. In the majority of cases work is stopped as soon as the contents fall below what is considered payable, and operations are then transferred to some part where there are richer prospects. This greatly increases the cost of mining, and it has been proved to be better to continue, even though the wash for some feet may be unpayable, the average return still giving a profit.

It has been estimated that in ordinary working six men raise an average of from 12 to 15 tons (24 tons being quite exceptional) of wash a week, which is equivalent to only 2½ tons per week per man. This, it is generally acknowledged, could be greatly improved upon were the miners seized of the necessity.

Those of the claims which have connected with adjacent workings have good natural ventilation. In the others ventilation is assisted by "centring" (*i.e.*, partitioning) the shaft and carrying out two drives or one double drive; and most of them are in addition provided with hand-blowers. At the "Pumpkins" a windsail is also attached to the ventilating pipe. (Plate 1.)

4. MILLWORK.

The Black Ridge battery, fifteen head of stamps, is capable of putting through 40 tons of "cement" per twenty-four hours. "The slimy sands carry 1 dwt. per ton, and the pure slimes 1 dwt. 7 gr. per ton, while the pure sands are quite free of gold." (Plate 2.)

Mr. Donald Fraser, manager of the battery, has supplied me with the following returns:—

> Middle May, 1905, till 13th Sept., 1905: 2,387 tons cement crushed for "an average yield of nearly an ounce."

Of this quantity—

> 285 tons was put through as a trial, and gave only 1 dwt. per ton, including 65 tons trial from the old Black Ridge puddler tailings.

(*a*) *Amalgamation*.—Mr. Fraser informed me that the gold in the oxidised "cement" will not amalgamate except after trituration (*i.e.*, prolonged battery treatment), probably owing to a coating of iron oxides. Further, that when coaly bands are present in the wash, the mercury is "sickened" during retorting. This may be due to the presence of sulphur in the coal.

5. COSTS.

The following items of local costs may prove of interest to some:—

(*a*) *Whim and Poppet-legs*.—

Round timbers (eight legs, tie-beams and crosspieces) delivered at the mine	£3	5
Sawn timber (for whim frame)...	2	5
Contract price for erection	13	0
	£18	10

This is one special case; on other claims the total cost has been from £20 to £30.

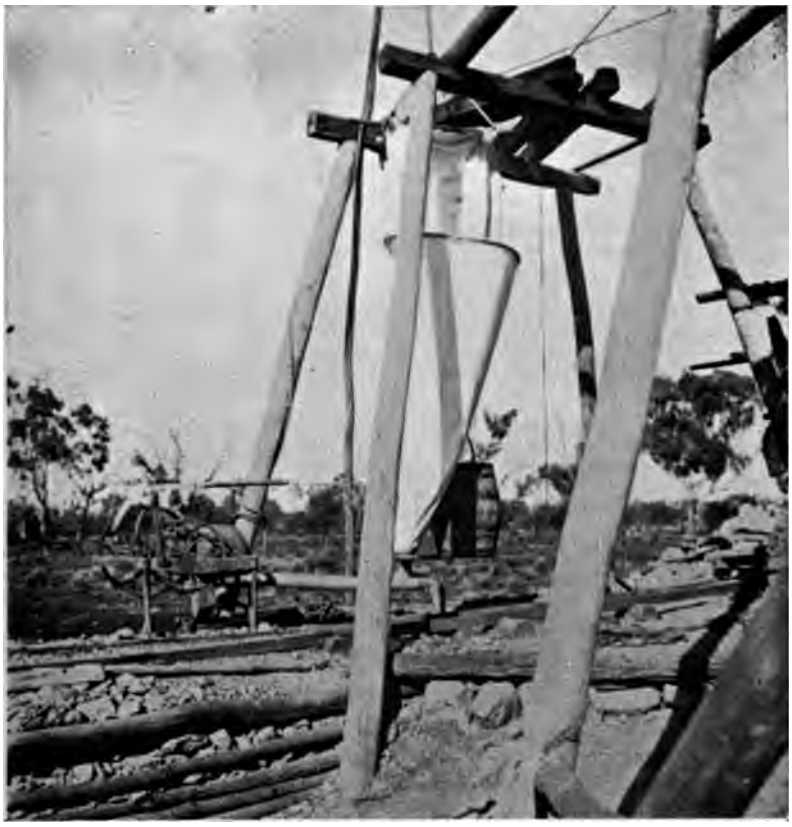

Photo., L.C.B. **Plate 1.**

VENTILATING APPLIANCES, "PUMPKINS," BLACK RIDGE.

"BUFFALO" HAND-BLOWER, WITH ATTACHED WINDSAIL.

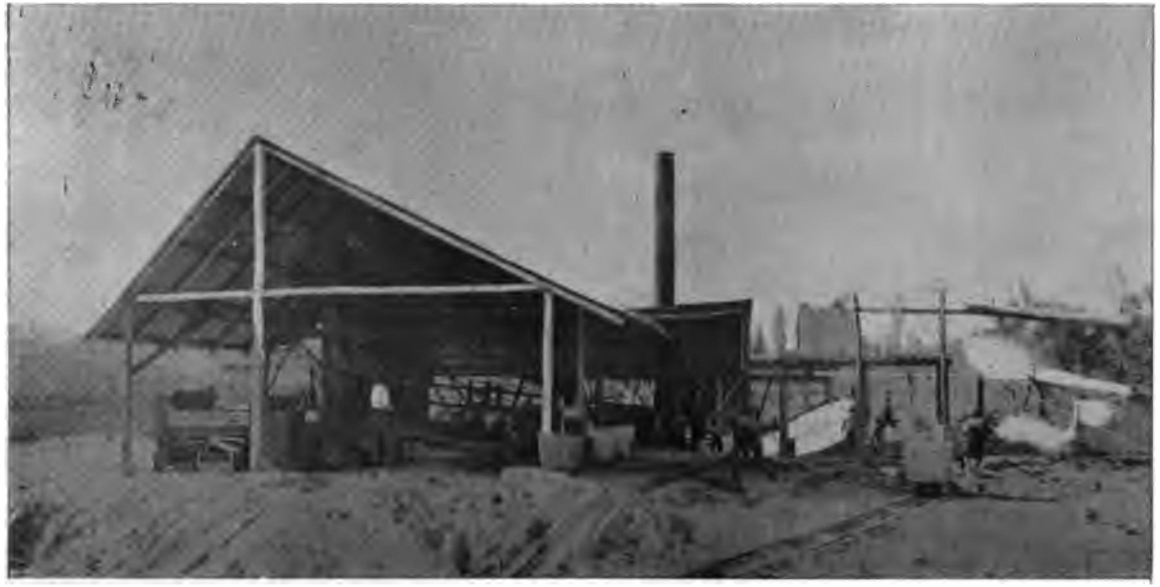

Photo., L.C.B. BATTERY, BLACK RIDGE. Plate 2.

(*b*) ***Mining and Hauling.***—The total cost of labour (calculating at the local rates) of raising and paddocking a ton of crushing stuff, in the most favourable instances, does not fall far short of £1 per ton, and in the others is far greater. The cost in 200 to 250 feet ground of raising and crushing, in addition to the actual labour of the six (four to ten) claimholders, is 16s. to 17s. per ton.

(*c*) ***Crushing.***—The following are the charges for crushing (including carting from the claim) at the Black Ridge battery:—

"Cement" (carrying ½ oz. or over)	12s. 6d. per ton
"Cement" (carrying under ½ oz.)	10s. per ton

For crushing only (as at Copperfield) the rate is:—

Quartz (up to 25 tons)	16s. per ton

6. OUTPUT.

The 1905 returns, given below, have been taken from the Warden's monthly reports in the "Queensland Government Mining Journal," but the Warden since reports these to be only partial returns:—

Jan. Feb. Mar.	446½ tons, yielding ...	... ...		478 oz.	625½ oz.
	Puddlers, ,,	... ...		147½ oz.	
Apr. May June	311 tons, ,,	147 oz.	... ...	...	1,144 oz.
	? ,, ,,	997 oz.			
July Aug. Sept.	365½*,, ,,	190 oz.	6 dwt.	190 oz.	878 oz.
	755½ ,, ,,	687 oz.	14 dwt.	688 oz.	

The value of the gold is given as £4 per ounce.

III. BLACK RIDGE CLAIMS.

Descriptions of the claims on the Deep Ground and one or two other localities are given below.

My time would not permit me, and it was not considered necessary, to revisit the old claims on the Old Cricket Ground and Daintree's Knob and the new ones on the Blue Ground.

1. DEEP GROUND.

The "Nipper," "True Blue," "Eldorado," "Bantam," "Pumpkins," "Pengelly's and Young's," and "Last Chance" had been pegged out at the time of my last visit a year ago. New claims west and north of them are:—The "Eclipse," "Endearer," "Rip and Tare," "Ruby," "Neiht's," "Perseverance," "Family Circle," "Southern Cross," "Dolphin," and "Contract." New claims to the south are:—"Just-in-Time," "Hope," McLoskey's Mistake," "Rejected," "Neiht's New," "Brilliant," "Just-in-Time No. 2," "Just a Chance," "Homeward Bound," "Jackson's," "Excelsior," "Waratah," "Moonshine," "Dido," "Star of the South," "Try Again," "Eureka," "Allan's," and "Hopeful."

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* Among the July crushings was one of 200 tons of mullock for 12 oz. 10 dwt.

The extreme northern shafts (the "Family Circle," "Dolphin," "Southern Cross," and "Contract") succeeded in bottoming, but not on payable wash. Comparatively little prospecting was done owing to want of funds, but it is quite possible that runs of payable wash may lie between the shafts, the prospecting having been altogether insufficient to prove the contrary. "Pengelly's and Young's" is the only claim on the north from which crushing stuff has been sent to the battery.

The north-western shafts (the "Ruby," "Neiht's," "Perseverance," "Rip and Tear," and "Last Chance") struck such heavy water that the sinking had to be stopped before bedrock was reached.

While there is nothing to show positively that payable wash will be found in this part of the field, there is every justification for the sinking of these shafts. The "Southern Cross" workings, the furthest to the north-west, should be extended, as the proving of payable gold here would open up a large extent of untried ground.

On the west the "Eclipse" is raising payable wash.

South-westwards "Neiht's New," "Just a Chance," "Star of the South," "Homeward Bound," and "Try Again" are still sinking. It is not known for what special reason these claims were located here except perhaps because good gold is being got in the "Eclipse," south of the shaft. Runs may, of course, be found, but the probability [illegible] against any considerable belt of auriferous ground lying in this direction, for the schists outcrop within a quarter of a mile, and no surface gold has been found on them.

On the south the "Just-in-Time," "Hope," and "McLoskey's Mistake" are in rich ground; and the "Brilliant," "Just-in-Time No. [illegible]" "Rejected," and "Dido" are working; but the other claims south and south-east have been abandoned. The ground south of the old [illegible] claims and their "side liners" appears to be a poor belt, the continuation of which was found to the east in the Blue Ground.

The claims are taken below in alphabetical order, and particulars are given as far as possible with reference to—

i. Extent of claim and location of main shaft.
ii. Area of workings, methods of working, &c.
iii. Influx of water.
iv. Character of wash and bottom.
v. Nature of bedrock.
vi. Condition of crushing material.
vii. Output.

Where they have a registered title, the claims have been described under it, even though some other name, often that of a shareholder,

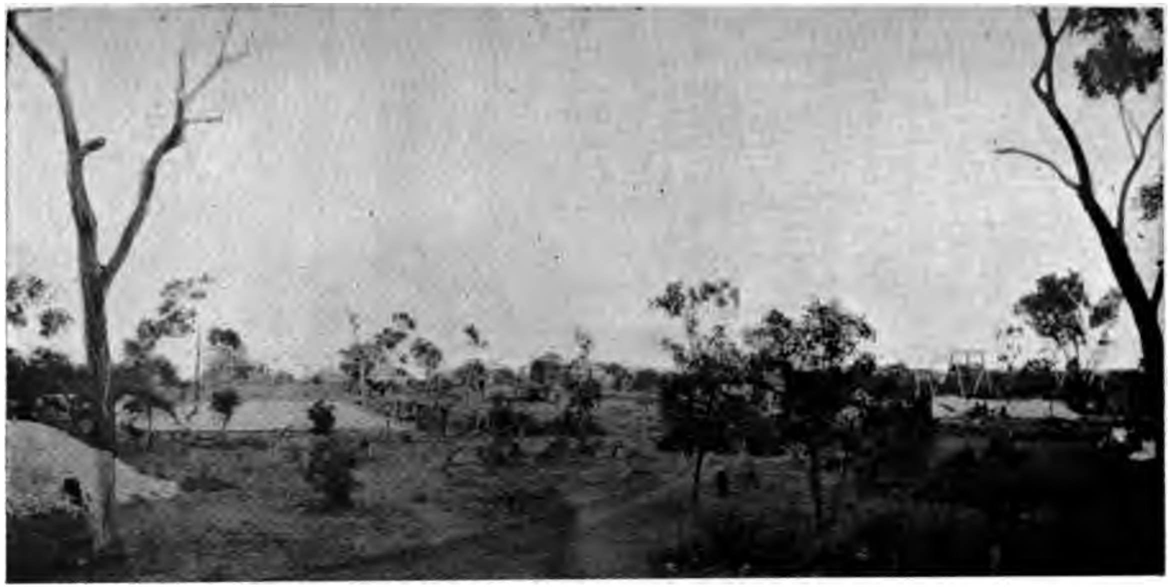

Photo., L.C.B. DEEP GROUND, BLACK RIDGE. **Plate 3.**

(LOOKING WESTERLY FROM THE "TRUE BLUE.")

may be in more common use, the latter being then given in parentheses. Much unnecessary inconvenience is caused people on and off the field by the careless method hitherto used in referring to workings and recording of outputs.

"*Allan's*" (Grace's, &c)—

i. The claim was abandoned in April, 1905. Position: 13 chains south of the "Nipper."

ii. The shaft is 184 feet deep.

iv. There is reported to be coaly shale in the shaft about 4 or 5 feet above bottom.

vii. No particulars could be obtained as to output, but the headings on the tip contained sufficient gold to make it worth while dry-blowing them (September, 1905).

"*Bantam*" (Heuat's, Christensen's, Caldwell's)—

i. Area: Six men's ground. Position: 4 chains west by north of the "Eldorado."

ii. The shaft (5 feet by 2 feet) is 234 feet to bedrock, and bottomed in August, 1904. A stope was opened for 30 feet west of the shaft and 40 feet south. A drive (130 feet to the boundary) connects with "McLoskey's Mistake" shaft, and from it a stope, 45 feet wide, has been carried about 60 feet eastwards, in proximity to the boundary. The present face is on the western side of this drive. Future work will be on the north-eastern side of the shaft.

The following items of costs per ton of ore have been supplied to the Warden:—Explosives, 5s. 4d.; horse feed, 2s. 1d.; wear and tear material, 1s. 6d.; candles, 2s. The total cost, with crushing at 12s. 6d. and mintage, &c., at 2s., is thus, exclusive of labour, 25s. 5d. per ton.

iii. No water.

iv. Conglomerate (with "smooth floors," 5 or 10 feet apart, and not all dipping in the same direction) was entered in the shaft at a depth of 107 feet. "Colours" of gold occurred in the conglomerate just above these floors, and also at a depth of 225 feet. A coal seam, ½-inch thick, was cut in sinking, and coaly shale, said to be sometimes auriferous, also occurs in the wash. The wash is reported to carry a little mineral (pyrite), though I saw none.

In the southern stope is an area of schist tish, 20 feet across and 2 feet thick, and colours of gold are reported beneath it on bottom. In the same place the section shown in Fig. 2 is to be seen, pay wash occurring both above and below a bed of very fine, almost barren, wash. The richest gold (amounting to 4 dwt. to the dish) is between thin patches of coaly shale and the bottom. The whole 6 feet average 9¾ dwt. per ton.

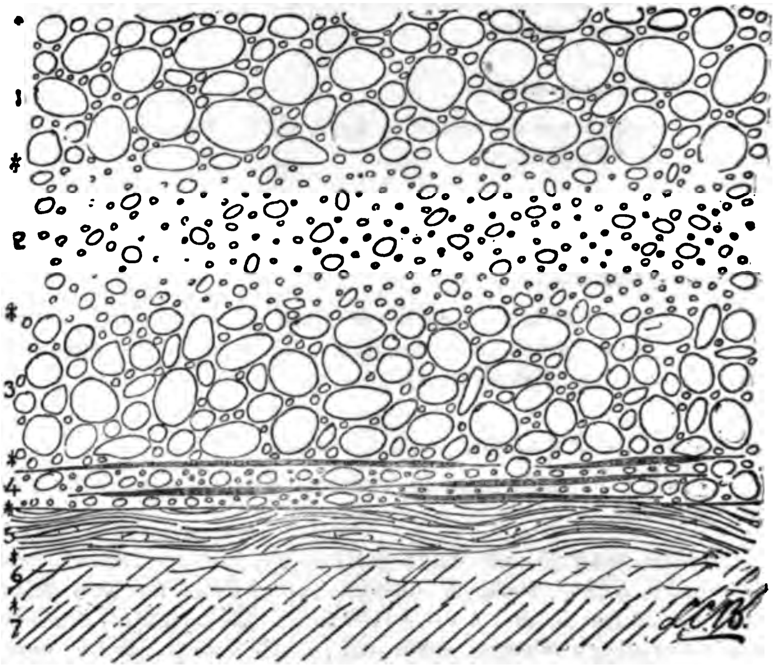

FIG. 2.—SECTION OF WASH, LOOKING NORTH NEAR "ELDORADO" BOUNDARY, "BANTAM."

Scale: 2 ft. to an inch.

1. Coarse wash, 10 *to* 12 *dwt. gold per ton.*
2. Very fine sandy wash, containing "colours" only.
3. Coarse wash, ½ oz. per ton.
4. Wash, with ½-in. layers of black shale, 4 *dwt. to the dish.*
5. Leader schist with quartz lenses.
6. Broken schist.
7. Solid schist.

The general slope of bottom is somewhat interfered with in this claim by a west-north-west channel crossing between the shaft and "McLoskey's Mistake." The slope, on the whole, however, is northwards or noth-north-eastwards, usually at 1 in 10, though there are still deeper slopes (one in the eastern face being 1 in 5 to the north-east). The bottom throughout the claim is polished, and there are signs of projections of bedrock having been shorn off during the movements producing the slickensides.

v. Bedrock is massive schist, which in some parts has, for a foot beneath wash, been veined with flat lenticular leaders of quartz. The faces of the joints are then often coated with a white kaolin.

When the schists are on edge, colours of gold are found in them as much as a foot beneath bottom. In places the upper portions of the laminæ appear to have been bent over (from south to north) by the pressure of the superincumbent moving mass. On the extreme southern face the bedrock is much contorted and jumbled, and the wash is poorer.

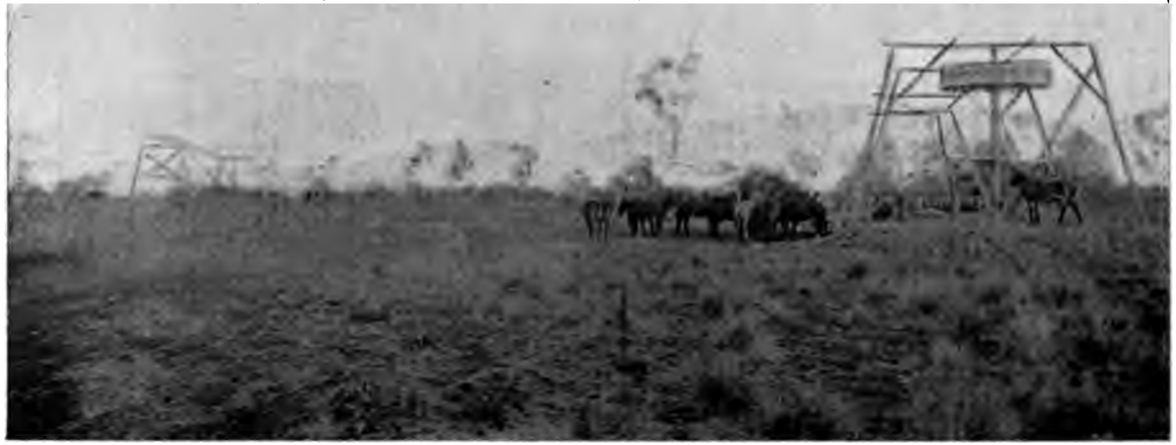

Photo., L.C.B.

DEEP GROUND, BLACK RIDGE.

Plate 4.

(LOOKING EASTERLY FROM NORTH-WEST OF THE "RIP AND TEAR.")

vi. Up to 6 feet of wash (with auriferous bands) has been broken down.

In the stope west of the shaft only 12 inches of wash (most of the gold being in the 6-inch beneath a coaly shale) and 6-inch bedrock was taken. In one place 1 inch of "puggy wash" beneath the cement carries ¼-dwt. to ½-dwt. to the dish. In the extreme south of the southern stope from 12 to 18 inches is payable, and on the northern side of the stope 3 to 6 feet, though in the centre of the stope the wash was only 12 inches thick. In the present face near "McLoskey's Mistake" 12-inch wash and 4 to 6 inch bedrock is removed for treatment.

vii. Output*: From the stope at the shaft—

Total 1904: 135 tons for 188 oz. =1 oz. 8 dwt. per ton.

From the drive—

May, 1905: 62 tons for 65 oz. 15 dwt. =1 oz. 1 dwt. per ton.
July, 1905: 200 tons (mullock) 12 oz. 10 dwt.

From the southern stope—

July, 1905: 185 tons for 204 oz. 14 dwt. =1 oz. 2 dwt. per ton.
Aug., 1905: 118 tons for 82 oz. 15 dwt. =14 dwt. per ton.
Sept., 1905: 52 tons for 25 oz. 12 dwt. 12 gr. = 10 dwt, per ton.

The last crushing included 6-feet ground.

The claim has paid shareholders from £6 to £9 per man per week since bottoming. The last crushing, which took three weeks to raise, gave £6 a week, and the August crushing gave £7 per week per man for six weeks' work.

Battery Well—

i. Position: 14 chains north-west by west of "Pumpkins."

ii. This shaft is now (September, 1905) 119 feet deep.

iii. The amount of water raised is 500 gallons an hour.

iv. It was sunk in solid basalt to 100 feet; then in vesicular water-bearing basalt to 119 feet. The basalt is somewhat decomposed, and veined with green halloysite (hydrous silicate of alumina).

"Bedford's" Old—

i. Two or three parties, including Mason, have lately cleaned the shaft out, but no crushing has been raised. That given by the Warden as Hickey's or Mason's came from Carroll's claim or Daintree's Knob.

ii. The shaft, 209 feet deep, is still inaccessible. The western drive has been carried forward 60 feet, and the southern 40 feet.

iv. It is understood that gold was found wherever there was any "wash."

The slope of bottom is 1 in 4 to the north-west.

"Bergman's"—

i. Position: 10 chains west-south-west of Grant's hut on Daintree's Knob.

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* The Warden's return for 1905 is 575¼ tons for 526 oz.

ii. The shaft is 101 feet deep. It is now caved in.

iv. Colours are reported to have been found from 100 to 101 feet. Beneath the wash is barren tish.

"*Bottle-tree*" (Dequine's and Dixon's)—

i. The Bottle-tree prospecting area includes two men's ground (200 by 200 feet), and is temporarily abandoned. Position: It lies about a mile north-east of the Seventeen-mile Well, and 2½ miles north-west of the Black Ridge battery.

ii. The shaft is 116 feet deep.

iii. At 110 feet depth a flow of water (50 gallons a day) was struck and proved too heavy for the two men to overcome.

iv. The sinking consisted of "billy" and clinker at surface; then soft white sand and clay to 60 feet; and then conglomerate and sandstone. The conglomerate is typical oxidised Black Ridge cement, white in the upper part, but reddish in the lower. Traces of gold were occasionally found in the sinking.

Two shafts on the creek about 15 chains to the north-north-east appear to have met a tish or schist bottom dipping westwards within 30 feet of the surface. The hill rising above them on the north is probably tish; it is not conglomerate.

The "Bottle-tree" has an important bearing on the future of the Ridge, in that it proves the continuation of the coal measures northwards.

"*Brilliant*" (originally Greave's and Meare's, now Wilson's)—

i. Area: Six men's ground. Position: 5 chains south-south-east of the "Nipper."

ii. The shaft is 214 feet deep (to bedrock). From the shaft the ground has been worked out for 1½ chains to the south, and round for ½-chain to the west, the reason for not continuing the stopes in this direction being the proximity to the boundary. A prospecting drive to the north-north-east is now (September, 1905) 100 feet in length.

iv. The wash is neutral tinted. The bottom slopes very slightly westwards, without any sign of pug, beneath the gold or elsewhere.

v. Bedrock is flat-bedded, massive, slaty schist, which, in the face of the northern drive, is becoming softer, and therefore more promising for the occurrence of gold. It is here fissured to some extent, and east and west cracks pass from it into the wash, with a noticeable effect on its productiveness.

vi. About 9 inches of bedrock and wash is crushed, the gold being chiefly on cracks in the schist. The contents vary greatly, 4 gr. to the dish (1 oz. to the ton) being sometimes found after a week's run on little or nothing; in fact, "the prospects are patchy." In the old workings 7 dwt. to the dish once resulted. It is considered that

12½ dwt. per ton would pay well if uniformly distributed, but that amount does not pay while it is necessary to be continually running out prospecting drives.

vii. The output from the ground south-west of the shaft comprises—

Feb., 1905: 24 tons for 9 oz. 10 dwt. = 8 dwt. per ton.
April, 1905: 41 tons = 7½ dwt. per ton.
May, 1905: 25 tons for 20 oz. = 16 dwt. per ton.
July, 1905: 58 tons for 21 oz. = 7¼ dwt. per ton.
Aug., 1905: 55 tons for 34 oz. = 12½ dwt. per ton.

"*Contract*" (Borl's originally, and later Linton's)—

i. Area: Nine men's ground. Abandoned by Borl in May, 1905. Position: 13 chains north of "Pumpkins."

ii. This, the biggest local shaft (6 feet 1 inch by 2 feet 6 inches), is 259 feet deep (to schist), and is still accessible. Drives extend for 13 feet to the south-west, and for 16 feet to the east.

iii. There is a slight seepage from the cement in the north-eastern corner of the shaft, probably noticeable only in damp weather.

iv. It is reported that no coal was cut in sinking. The cement may be rather more indurated than is favourable, but the drives being in bedrock, only the lower 3 inches to 12 inches has been exposed. It is here rather more pebbly than in the "Family Circle," and in places is somewhat sandy. Shotty colours were reported to have been found in July, 1905.

In the face of the south-western drive is a jump-up (not a fault) of at least 12 inches to the south-west; the slope of the bottom is elsewhere very slight—viz., west of the shaft 1 in 40 to the north-west, and east of the shaft 1 in 30 to the south-west.

v. Bedrock is foliated neutral tinted or blue and white schist, the foliæ of which dip only very slightly (to the south-west). For from 6 inches to 12 inches below the cement the bedrock has been crushed, or is rather more openly laminated than below. In this part, especially, white, clayey seams have been developed on the laminæ. There seems to be sometimes ¼-inch pug, 3 inches below bottom.

"*Dido*" (Dequine's and Collin's, originally O'Hara's "Blackbutt")—

i. Area: Six men's ground. Position: 7 chains south of the "Bantam."

ii. The shaft is 199 feet deep. Old drives run 30 feet north and 5 feet south of the shaft, and a little ground was stoped out near the shaft. A drive is now being carried up the slope to the west-south-west. The workings were not inspected by me.

iv. The thickness of basalt pierced in the shaft is 30 feet. The strata beneath the basalt dip to the east in the shaft, but to the west in the western drive. No colours have yet been found.

There is a sudden rise (fault?) forming a "bar" a few feet west of the shaft, the bottom being now nearly level. The drive from th shaft was carried through the "bar," and is now half in wash and hal in bedrock.

vii. Neither the original nor the present party has had a crushing.

"*Dolphin*" (Finger's, "Cockey's," or "Douglas Creek party")—

i. Area: Nine men's ground. Exempt. Position: 10 chains north of "Pumpkins."

ii. The shaft reached 256 feet from the surface. There are short drives 12 feet in length to the south-west, and 12 feet in length to the east. Inaccessible.

iii. The water amounted to only 15 or 20 gallons an hour.

iv. White billy sand seems to have been struck beneath the basalt.

The wash contains still more quartz than that in the "Contract." Colours of gold were found on opening out from the shaft.

The slope of bottom was towards "Pengelly's and Young's."

"*Eclipse*" (Madge's and Croft's)—

i. Area: Six men's ground. Position: 3½ chains west of "Pumpkins."

ii. The shaft (5 by 2) is 204 feet deep (expected? 270 feet.) From it a face was carried out for 25 feet across the dip to the east-south-east. The present face, 30 feet in width, is being carried to the south-south-west to the rise, and is now 60 feet from the shaft. A drive on the north-north-east of the shaft is 10 feet in length. On account of the steep slope of bottom in this drive, the shaft is to be continued from 11 to 15 feet below the wash, and a drive will then be put out to the north to catch the wash on the dip.

iii. Water has been struck both in sinking and in opening out in the cement, the total amounting to 300 gallons a day, of which only 20 gallons comes from the cement.

iv. The reddish oxidised, but barren, cement changed to blue at about 180 feet depth, and colours of gold were found in this as much as 15 feet above bedrock.

The wash has much the appearance of tish, and, like the bedrock, has a strong reddish tint, while it contains abundant quartz pebbles, which are not well-rounded, though they generally have their edges worn off. The larger boulders are always fairly well rounded. That it is of sedimentary origin is proved by the occurrence of layers of shale in it, both in the southern stope (where fossiliferous), in the eastern

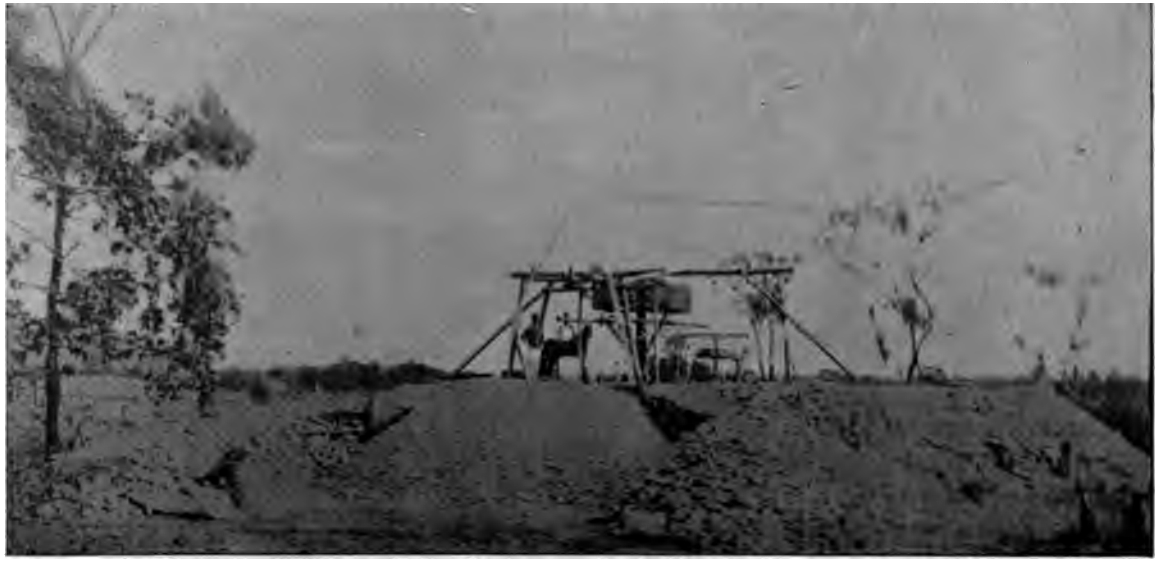

Photo., L.C.B. THE "ELDORADO," BLACK RIDGE. Plate 5.

(SHOWING PADDOCK OF CRUSHING STUFF AND HEAPS OF REJECTED BOULDERS.)

face where it rests on bottom, and in the northern drives where it is 2 feet from bottom and accompanied by a large quantity of quartz pebbles.

Gold occurs both above and below the shale patches, and it is found to be richer when the wash is fairly coarse, with abundant quartz boulders. It is also, contrary to the usual expectation, better here when the bedrock hardens. A "pug" in the bottom of a pot-hole was reported to have swelled upon exposure. In one place shotty gold was found, one speck weighing 7 dwt. Most of it is, however, less than ⅛-inch in diameter, flaky, and sometimes crumpled. "Specimen" gold is also found, the gold having been perhaps precipitated on angular quartz fragments.

The slope of bottom varies between north-north-west and north-north-east, and south of the shaft is only 1 in 20; but just to the north of the shaft it abruptly falls off to 1 in 4; within a few feet is 1 in 1, and in the face of the drive is 1 in ½ to north 2° east. This steep dip indicates the existence of a deep channel between the "Eclipse" and "Endearer."

v. The bedrock is soft, foliated schist, the laminæ of which dip about 30° to the south-west.

vi. Between 6 inches and 3 feet 6 inches of wash (an average of 2 feet) is broken down for treatment; in the eastern face 2 feet 3 inches wash and 2 inches bedrock carry 8 dwt. per ton.

vii. The output* consists of:—

April, 1905: 62 tons yielded 33 oz. = 10 dwt. 15 gr. per ton.
July, 1905: 57½ tons yielded 23 oz. = 8 dwt. per ton.
Aug., 1905: 80 tons yielded 58 oz. 8 dwt. = 14 dwt. per ton (a month's work).
Oct., 1905: 78 tons = 7 dwt. per ton.

"*Eldorado*" (Hennessey's and Keane's)—

i. Area: Six men's ground. Position: 3½ chains west of "True Blue."

ii. The shaft is 240 feet deep. A face 45 to 50 feet wide has been carried 55 feet northwards from the shaft along the "True Blue" boundary and southwards 100 feet to the "Hope." The present face south-west of the shaft has been carried 70 feet along the "Hope" and "McLoskey's Mistake" boundaries. The workings are connected with the "True Blue."

iii. In sinking red cement was met at 88 feet from the surface, the change to blue taking place at 150 feet, where there is a 3-inch seam of coal, which was used in the forge for sharpening picks. Another 1-inch seam of coaly shale was found at a depth of 230 feet.

The wash contains much granite, especially north of the shaft, where it is also very coarse. The best gold has been found where there is "dig" on bottom, the ground west of the shaft, where it is absent, being poor. The wash, north of the shaft, has averaged 24 dwt. p ton, and much of that south of the shaft ran 1 oz. The richest grou was in the vicinity of the shaft.

---

* Warden's return for 1905: 484 tons for 194 oz. 6 dwt. 13 gr.

In one place about 30 feet south-west of the shaft 2 feet of ti occurs in a depression in the bottom. Though 3 gr. to the dish h been obtained from the wash above it, the tish does not carry trace of gold. The slope of bottom south of the shaft varies fr almost level to 1 in 10 to the north-west, and north of the shaft it 1 in 30 to the west. A channel ran south-eastwards past the shaft the south.

v. The bedrock is slaty schist dipping flatly westwards.

vi. Over a considerable area south, and to some extent north, the shaft 2 feet 6 inches wash was broken down for treatment. Fr 2 feet 6 inches to 3 feet wash is exposed now in the northern f but west of the shaft it is thin and poor, while south-westwards fr 9 inches to a foot is taken. In the present face on "McLoskey's M take" boundary 6-inch wash and 3-inch bedrock is taken.

vii. The following is the output*:—

Total for 1904: $316\frac{1}{20}$ tons for 591 oz. = 1 oz. 12 dwt. per ton
Feb., 1905: 75 tons = 23 dwt. per ton.
30 tons (mullock) = 8 dwt. per ton.
125 (?) tons (mullock) for 27 oz.
June, 1905: 217 tons for 195 oz. = 18 dwt. per ton.
Aug., 1905: 77 tons (including 20 tons of ½-oz. "headings") for 149 oz. 14 dwt. = 1 oz. 19 dwt. per ton.
Sept., 1905: 75 tons for 112 oz. = 1 oz. 10 dwt. per ton.

The mullock consisted of packing in the stopes, and included as mu as 3 feet of bedrock, from where the 5-oz. crushings were obtained the southern side of the shaft.

"*Endearer*" ("Endeavour," Tasker's, or "Spaniard's")—

i. **Area**: Six men's ground. Now exempt. **Position**: 4 chai north-west of the "Pumpkins."

ii. The shaft is 197 feet to bedrock, and now is accessible. drive was opened on the underlie for 12 feet. The shaft was then co tinued into bedrock to a total depth of 212 feet, and a drive w carried out to the wash and along bottom for 62 feet to the nort north-east (falling 25 feet). This was because of the bottom formi an overhanging ledge, as shown in Fig. 3. A drive was also opene for 12 feet on the rise to the south-west. It is the shareholders' inte tion, on resuming work, to drive 60 feet to the south.

iii. The bottom of the main water zone is 135 feet below tl surface; but water also came from leaders in bedrock.

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[*] Warden's return for 1905: 550 tons for 668 oz. 7 dwt.

iv. The wash is favourable in appearance, but contains no gold. The bottom is reported to slope 1 in 1½ towards the north-north-east.

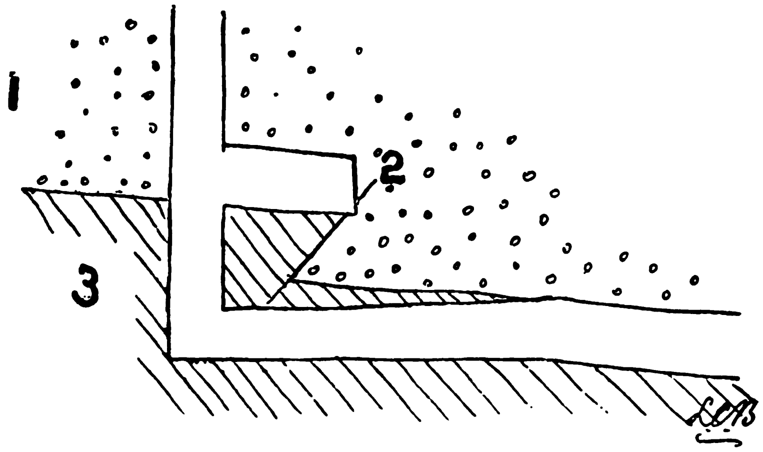

FIG. 3.—FAULT IN "ENDEARER."

Scale: 20 ft to an inch.

1. Wash.
2. Fault.
3. Schist.

"*Eureka*" (Kelly's, Pugh's, or Agnew's)—

i. Abandoned early in September, 1905. Position: 9½ chains south-south-east of "Eldorado."

ii. The shaft is 200 feet deep, with drives 50 feet, 58 feet (east), 16 feet (south), and 35 feet (west). Inaccessible.

iv. The wash was very thin, and the run was only 10 feet in width.

vii. The output comprises:—

19½ tons	for 10 dwt. per ton
45 tons	for ½ oz. per ton

(including 22 tons, yielding 11 oz. 8 dwt. = 10 dwt. per ton.)

The headings are now (September, 1905) being dry-blown.

"*Excelsior*" (Lyall's)—

i. Area: Six men's ground. Abandoned. Position: 8½ chains south-south-east of the "True Blue."

ii. The shaft is 203 feet to schist, and was continued 6 feet, when a drive was opened. Inaccessible.

iv. A large body of low-grade wash was reported to occur here. The slope of bottom is 1½ in 1 to the east.

vii. Output:—

June, 1905: 18 tons for 3 dwt. per ton.

"*Family Circle*" (Ambrose's)—

i. Area: Nine men's ground. Exempt. Position: 10 chains north-west of the "Nipper."

ii. The shaft is 245 feet deep; the eastern drive is 80 feet lon the western 15 feet. These workings are now flooded by water fr the cement, and are inaccessible.

iii. There is reported to have been an open water-bearing vugg the cement in the shaft, and 2,500 gallons a day was raised wh sinking. It is understood that no coaly shale was found in the sh The neutral tinted cement on the tip is made up in great part micaceous schist, but contains also much spotted schist and most the boulders are less than a foot in diameter.

This was reported a "duffer," but it is rumoured that fair pr pects (½-oz. per ton) were found at from 20 to 35 feet in the easte drive, and I saw colours myself in the stone on the brace. No g occurred on bottom, but as much as 2 gr. to the dish 2 feet abo (*Peak Downs Telegram*, December, 1905).

The slope of bottom is, according to some, towards the "Co tract," according to others towards the north.

"*Homeward Bound*" (Lewis's)—

i. Position: 10 chains west-south-west of "Pumpkins."

iv. At 60 feet depth, just passing from brown decomposed int solid blue basalt, needing to be blasted.

"*Hope*" (Moylan's, McMillan's, Potts's, Taylor's)—

i. Area: Six men's ground. Position: 2½ chains south-south-wes of "Eldorado").

ii. The shaft is 230 feet deep. From it the ground has bee stoped northwards 20 feet (to the "Eldorado") eastwards 37 feet westwards 20 feet, and south-westwards 20 feet.

iii. The workings are now quite dry.

iv. The change to blue ground was reported at 200 feet depth

The wash is similar to that on the adjoining claims. Pug occu on bottom north-west of the shaft and good gold is found there.

The slope of bottom is 1 in 30 north-westwards.

v. Bedrock is laminated blue slaty schist; and the laminæ di 45° to the west.

vi. The crushing material comprises 12 inches of wash and 6 o 8 inches of bedrock.

vii. The output* is:—

May, 1905: 57 tons yielding 22 dwt. per ton (largest piece 16 dwt)
Aug., 1905: 75 tons yielding 81 oz. = 21 dwt. per ton.
Sept., 1905: 45 tons.

"*Hopeful*" (Donaldson's)—

i. Area: Six men's ground. Abandoned. Position: 12 chain south of "Eldorado."

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* Warden's return for 1905: 247 tons.

ii. The shaft is 158 feet deep. It was considered that the shaft bottomed too shallow, and, as no gold was found at the shaft, no further work was done.

"*Jackson's*"—

i. Area: Six men's ground. Abandoned, June, 1905. Position: 10½ chains south of Mason's.

ii. The shaft is 205 feet deep.

iv. The bottom slopes west.

vii. One small crushing was made and the ground was then abandoned:—

May, 1905: 16 tons for 4 oz. 6 dwt. = 5 dwt. per ton.

"*Just-a-Chance*" (Lloyd's)—

i. Position: 5 chains south-south-west of "Pumpkins."

ii. The shaft is in process of sinking.

iv. The base of the basalt sloping 1 in 1½ was met at a depth of 87 feet. None of the basalt is vesicular here, and no water was found in it.

"*Just-in-Time*" (McDonnell's)—

i. Area: Six men's ground. Position: 2 chains south-south-east of Eldorado.

ii. The shaft is 243 feet deep (also reported that schist was struck at 233 feet, and shaft was continued 3 feet), from it the worked-out ground extends 60 feet west to the "Hope" boundary, along which the face is being carried southwards. Connection has been made with the "True Blue" and "Hope" workings, between which the stope lies.

iii. The workings are now quite dry, though the strata were slightly moist when the shaft was just opened.

iv. The blue country was entered at 100 feet depth, but in the "Hope" adjoining not till 200 feet depth, though there is a small area of oxidised wash at one place in the southern face. It is generally understood that this is the only claim on good gold in which coaly shale does not occur in the cement; but, in the 25-feet north-north-eastern drive connecting with Fraser's workings, a 6-inch bed of sandstone with ⅛-inch coats of coal both above and below, approaches to within 1 inch of bedrock. Beneath it there is good gold, but none in the sandstone itself or in the cement above.

In this claim, when the wash, though otherwise promising, is free from large boulders, the gold is absent, and the miners say "the wash cuts out." Strange to say, it has been proved that the wash is richest where thickest. The run of the thick rich wash has been from north-west to south-east across the stope. In the eastern face about 20 feet south of the shaft nearly all the gold is 2 feet 6 inches above bottom, and in the stope south-west of this run 18 inches of wash on bottom was very poor and most of it was thrown back as filling.

Fraser's run is expected further to the east.

The gold is generally fine, being less than $\frac{1}{10}$-inch in diameter, though one speck of 7 dwt. has been found. It is in thin flakes and arborescent forms, slightly rounded but not waterworn.

Though no pug is found, the bottom has a polished face everywhere that good gold occurs. In the south-western face the partings leave the bottom and run off into the headings, while the bedrock is much broken, and there is then no gold to speak of. It would seem that the faulting died out here.

v. The laminæ of the schist bedrock dip 60° to the west, and when open (separated) good gold is found between them for 1 or 2 inches below the bottom of the wash.

vi. The amount broken down for crushing varies between 2 or 3 inches and 2 or 3 feet (1 oz. at shaft).

A man in the paddock on the surface picks out all the larger boulders and scrubs them in water. If gold is attached, as is mostly the case just now, they are broken up and thrown back, but if none is seen they are cast aside as mentioned elsewhere.

vii. The output* is :—

Jan., 1905 : 61 tons crushed for 72 oz. = 1 oz. 3 dwt. per ton.
Mar., 1905 : 81 tons crushed for 173 oz. = 2 oz. 3 dwt. per ton.
June, 1905 : 117 tons crushed for 207 oz. = 1 oz. 15 dwt. per ton.
Aug., 1905 : 84 tons crushed for 105 oz. 14 dwt. = 1 oz. 5 dwt. per ton.

One slug of 3 oz. has been reported, and three or four of 1 oz.

"*Just-in-Time No. 2*" (Lloyd's, Hickey's)—

i. **Area:** Six men's ground. Position: 3½ chains south-south-east of "Pumpkins."

ii. The shaft is 195 feet deep to the false bottom, and 198 feet 6 inches to bedrock. The ground round the shaft has been stoped out for 5 feet east, 15 feet south, 15 feet west, and 20 feet north-west.

iii. No water was met in the basalt, but water is now oozing out of the cement.

iv. At a depth of 173 feet, 5 feet of quartzite wash, loosely cemented and carrying 1 gr. to the dish of very fine gold, was penetrated. A very slight increase in the contents would render this profitable ground.

The basal wash, like that in the "Eclipse," is tish-like, being composed chiefly of subangular schist, with considerable slightly-rounded quartz, the whole having a reddish tint. It is thus distinct from the ordinary cement of the Ridge.

There is no sharp division between the auriferous wash and the barren 3 feet 6 inches of quartz-bearing tish beneath, though the miners speak of the boundary (sloping about 1 in 10 to the north) as a false bottom. They have, in fact, much trouble in following the gold, which to the north-west of the shaft has run off flatly into the wash. In addition to this, there is sometimes a 6-inch sandy layer over the wash in the vicinity of which no gold is found.

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* Warden's return for 1905 : 485 tons for 707 oz.

The gold hitherto won has come principally from a trail running north-westwards through the shaft, and varying from a few inches on the south to 2 feet in width on the north-west. The wash on the trail is 2 or 3 inches thick, and yields 1 and 1½ dwt. to the dish, the prospects off it being only 2 or 3 gr. and less.

vi. For the crushing given below up to 2 feet 6 inches of wash was taken, as gold occurred throughout it.

vii. The output is:—

Sept., 1905: 53 tons 18 cwt., yielding 19½ oz. = 7 dwt. per ton.
Oct., 1905: 22 tons yielding 8 oz. 7 dwt. = 7 dwt. 12 gr. per ton.

(The latter was reported "from the higher level, where there is a large body of wash," presumably that at 173 feet depth.)

"*Last Chance*" (Raynor's, Bedford's).—

i. Area: Six men's ground. Exempt, April, 1905. Position (new): 3½ chains west-north-west of "Bantam."

ii. The first shaft, made too small, was abandoned at a depth of 120 feet, owing to the heavy water met, but Dequine assured me that his party drained the shaft in sinking the "Perseverance." The shaft is now leased as a well by the sawmillers.

The base of the basalt in this shaft dipped 1 in 1 towards the east, though in Dequine's it was dipping towards the west.

The new shaft (5 feet by 2 feet 6 inches) generally known as "Bedford's East," struck wash reported payable at 237 feet depth. The cost of sinking was £118. From this shaft the "Pumpkins" claimholders are now driving towards their shaft, so that it is possible to examine the workings: a drive extending north-north-east 50 feet, a tortuous drive extending west-north-westwards 70 feet, and the drive in use now reaching a distance of 55 feet to the west-south-west of the shaft.

iv. The wash in the northern drive is hard, and the lower 6 inches (the only part tried by the miners) is barren.

In the southern drive a fault plane dipping 75° east-south-eastwards has been followed from the shaft. This fault shows as a pug seam in the schists, and as a distinct waterline (from which water is now dipping) in the cement. The bottom has been faulted 8 or 9 inches in places, the downthrow being to the south-south-east. The fault was found in the shaft at least 20 feet above bedrock. The fact that a difference is noticeable between the cement on opposite sides of the shaft (it being heavier on the west) would indicate that some lateral movement has taken place.

The best gold has been found along this fault, and in the wash in the face prospects of 2 and 3 gr. to the dish are being the distribution of the gold, according to the prospecting, being :-

Upper : 2 ft. runs 2 gr. to dish (not tried above.)
Middle : 8 in. runs 4 gr.
Lower : 1 ft. 4 in. runs ½ gr.

The bottom is on the whole very flat, the greatest slope, t the end of the west-north-western drive, being 1 in 10 to the In the northern drive the slope of bottom is 1 in 20 to the There are no slickensides between cement and bedrock.

vi. In the west-north-western drive above 12 inches of wa been broken down.

vii. The only crushing thus far is :—

Feb., 1905 : 23½ tons for 11 oz. 10 dwt. = 9½ dwt. per ton.

"*McLoskey's Mistake*" (Herbert's)—

i. Area : Six men's ground. Position : 2 chains south of " Ba

ii. The shaft is 230 feet deep. From it a drive extends 20 the north ; then the ground east and south-east of the shaft ha stoped out to Heuat's boundary about 20 feet distant ; and a extends 50 feet south and 120 feet south-west.

iii. When the shaft was first sunk 100 gallons of water p had to be raised, but the amount gradually diminished till now slight seepage at intervals can be detected in the cement. Cr the cement were sometimes found to act as reservoirs, but soon r

iv. The sinking from 175 feet to 226 feet was in coarse co erate, and below in the fine conglomerate now worked. Th is poor when made up of fine gravel, as at the shaft and in the n drive (where the wash is auriferous only on bedrock, and when c ing a few large pebbles). In the present face on the south-w wash is well waterworn, with much rounded quartz—a good this claim. It is hard and stained reddish, but north-eastw changes rather abruptly (25 feet from the shaft) to the ordina cement.

The run of gold, which is taken as about 20 feet wide, is tr somewhat south of west.

Beneath the wash from 18 inches to 2 feet of barren schist-ti depressions in the bottom, especially south of the shaft.

" Partings " (slickensides) occur over limited areas both wash and on and in bedrock, and in one case above the tis the gold is not richer in their vicinity than elsewhere. In the so face, 35 feet from the shaft, there are greenish " heads " (fissure 6 inches to 1 foot above bottom. There is, however, no gold them, and little below.

The slope of bottom is slight (1 in 20), and is outwards fr shaft, which has therefore been sunk on a bump. In the south- drive the slope is again back towards the shaft.

v. The bedrock is schist, the laminæ of which dip south. The leaders in the schist, especially near the wash, appear to be in process of formation; the quartz is sintery and powdery, and the leaders are sometimes cavernous.

vi. The crushing stuff contains very little quartz. An average of 8 inches or 9 inches wash and 3 inches to 5 inches schist was taken east of the shaft; 10 inches total was taken on the south, 12 inches on the south-west.

vii. The output includes:—

From the stope east of the shaft—

Mar., 1905: 52 tons crushed 30 oz. 10 dwt. = 12 dwt. per ton.

From south of the shaft, taking 10 inches total—

June, 1905: 60 tons for 66 oz. = 22 dwt. per ton.

From the present south-western stope, taking about a foot of wash—

Aug., 1905: 52 tons for 101½ oz. = 1 oz 19 dwt. per ton.

"*Moonshine*" (Campbell's)—

i. Abandoned. Position: 6½ chains south-south-west of "True Blue."

ii. The shaft is 205 (?) feet deep. Some driving was done, but little gold was found.

iii. Output:—

Early in 1905 a small crushing yielded 9½ dwt. per ton,
And in July, 1905, 30 tons (trial) crushed for 5 dwt. per ton.

"*Neiht's*" (No. 88)—

i. Area: Six men's ground. Exempt. Position: 9½ chains north-west of the "Pumpkins."

ii. The shaft is 124 feet deep, and still in basalt.

iii. Very heavy water was struck in the basalt; a flow of 900 gallons an hour was measured, and it is believed it increased to 1,300 gallons, preventing the sinking.

"*Neiht's New*"—

i. Position: 6 chains west-south-west of the "Pumpkins."

ii. The shaft is now (September, 1905) sinking in the basalt.

"*Nipper*" (McGilliivray's)—

i. Area: Six men's ground.

ii. The shaft is 218 feet deep. The first stope (100 feet long and 40 feet wide) is on the "True Blue" boundary, which is 70 feet to the south of the shaft. The gold contents warranted further work to the eastwards, but the face was calculated to be 30 feet below the old flooded workings in McGillivray's Old (or "Mason's") Claim, and it was feared that the water might be tapped. The new stope is reached by a north-north-east drive 35 feet in length; it is 130 feet in length and 40 feet wide, and is being carried eastwards.

A small trail was found just north of the shaft, but it is too poor ($\frac{1}{2}$ oz. per ton) to be worked just yet.

Hand-drills were first introduced here on this field, having been brought over from the Blair Athol coal mines. The machine used is the Conqueror coal borer. It bores satisfactorily in the schist when free from quartz veins (8 holes, each $1\frac{1}{2}$ inches in diameter and 2 feet 6 inches long, in half a shift).

iii. No water.

iv. The wash here is best when coarse. Grey shale occurs in it in the northern workings, about 2 feet above bottom.

In the face of the northern stope there is now good gold 2 feet 6 inches above bottom and adjacent to bedrock, but none about a foot above the bottom. In the same face coaly seams occur in the 12 inches of wash near bottom, and gold is found both above and below them. An overlying 6-inch layer of sandstone and the superimposed "cement" are, however, barren.

McGillivray, who traced the gold from the old Blue Ground, believes that his northern trail runs from the bakehouse on Gowrie Creek, and passes east of "Mason's," but west of the "Fraud," and probably on to "Pengelly's and Young's."

There is no pug on bottom.

The slope of bottom in the northern workings (from scarcely anything to 1 in 10) is westerly and south-westerly, but in the northern drive it is 1 in 12 to the south-south-west.

v. The bedrock is massive schist, dipping 30° to the west-north-west. In it occur east and west cracks, which show evidence of being solution cracks, for good gold is often found in the wash above them, and in the cracks themselves for 2 inches below bottom.

vi. For crushing, 8 to 12 inches wash and 1 to 5 inches bedrock is taken.

vii. The output is:—

Warden's total for 1904: $349\frac{17}{20}$ tons for 261 oz. = 15 dwt. per ton.
First quarter of 1905: $45\frac{1}{2}$ tons for 34 oz. = 15 dwt. per ton.
225 tons for 129 oz. $7\frac{1}{2}$ dwt. = $11\frac{1}{2}$ dwt. per ton.
Aug., 1905: 80 tons for 40 oz. 12 dwt. = 10 dwt. per ton.
? Sept., 1905: 89 tons for 40 oz. = 9 dwt. per ton.

Northern Road—

i. Position: 580 paces north 234° east from "Homeward Bound."

ii. The shaft is 30 feet deep.

iii. The sinking was in doubtful kaolinised material, but from the bottom undoubted tish and light reddish schist have been raised. In any case schists can be seen in the creek bed a few chains east of the shaft.

"*Pengelly's and Young's*"—

i. The claim originally contained nine men's ground, but the hitherto disappointing results have caused four men to drop out, and the area has in consequence been reduced.* Position: 4 chains north-north-west of the "Eldorado."

ii. The shaft (2 feet 2 inches by 5 feet) is 243 feet deep. The sinking took 14 weeks, and the cost, exclusive of labour, was £114. Drives were first carried north by west for 35 feet, and west-north-west for 85 feet; and the ground intervening was then stoped out. This part of the workings, having been idle for some time, and being to the dip of the shaft, is to a great extent under water. A face has been carried from the western drive, 8 feet from the shaft, to the "Eldorado" boundary. A prospecting drive, expected to cut the "Nipper" run of gold within 60 feet, is now being carried eastwards from the shaft, with a face 15 feet in width, mullock being stowed up behind in the centre of the drive to produce two air-ways, and thus ensure good ventilation.

The natural ventilation is assisted after shot-firing by hanging a fire-bucket (a perforated oil drum) in the shaft for about three minutes.

The wash has to be blasted down, and Conqueror coal drills are used for boring the holes in the bedrock below the wash.

The present rate of advance of the eastern face is 9 or 10 feet a week, with two shifts.

iii. All the water in these workings comes from below a depth of 192 feet—*i.e.*, it is derived from the cement (conglomerate). The miners have found the flow to be chiefly from east and west "vugs" (cracks). The amount now raised is 100 gallons per twenty-four hours, but it varies considerably according to the state of the weather, being greater or less as the weather is dry or moist. The water is potable, having only a very slight sweetish taste.

iv. The wash or cement is the normal basal conglomerate of the Black Ridge, being composed of rounded pebbles and boulders (up to several hundred pounds in weight in the case of the granite) of schist, quartz, granite, quartzite, "pilot-stone," &c., and having a prevailing neutral tint.

It is reported that the best gold follows the granite boulders, but this may be more apparent than real, the gold being more apt to remain attached to the rough granite than to the smooth stones in the surrounding wash.

The "cement," as is general on the field, proved very poor where sandy—*e.g.*, along the "Eldorado" boundary south-east of the shaft, and in the faces north-west of the shaft, where a drive was continued 12 feet into it.

A fact of considerable importance was here first pointed out to me—viz., the occurrence of gold in the wash some feet above bottom, where the wash is almost or quite barren. Some 25 feet south of the shaft only a foot of cement has been tried, but it is confidently expected that the "headings" will prove richer.

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* Rechristened "New Perseverance."

A band of coaly shale, 3 or 4 inches thick, occurs in the cement, usually about 3 feet from the bottom, dipping, in the southern workings where exposed, at an angle of 5° to the west. As elsewhere indicated, the coaly seam near the base of the cement seems to have exercised some controlling influence on the deposition of the gold, yet the following section was observed on the "Eldorado" boundary south-west of the shaft:—

Roof : Coaly shale.
12 in. : Cement poor in gold.
12 in. : Cement richly auriferous (containing two-thirds of gold contents).
15 to 18 in. : Cement containing ½ gr. to 1 gr. to the dish.

The whole of the 3 feet 6 inches, when crushed, yielded an average of ½-oz. gold per ton.

As to the runs of gold, the ground on the northern side of the shaft is poor, while that on the southern was worth breaking down—giving prospects of ¼-dwt. to the dish, which is equivalent to 1½ oz. per ton. The edge of this run was along the north-western drive. It is expected that a run will shortly be met in the eastern drive, the latest prospects (14th September) being 4 gr. to the dish (1oz. to ton). The northern run in the "Nipper" is believed to be bending towards this claim.

It should also be noted that there is no pug between wash and bottom, the latter being, however, roughly grooved or troughed by the extension of the tougher or harder laminæ of bedrock. There is only occasional, very slight, and inconclusive evidence of movements between the coal measure and the schist here (south of the shaft). The slope of bottom varies between 1 in 10 and 1 in 20 to the west.

v. Thick-bedded schists occur beneath the wash, dipping westwards at a slightly greater angle than the coal measures. These are crossed by north-east, south-east, and east and west cracks. In places the schists are more fissile, and seamed with lenticular strings of quartz, lying parallel to the laminæ of the rock. My own observations seem to show (though they are not sufficiently exhaustive) that these leaders taper out towards the cement, often bending over at the bottom of that rock. This would tend to prove that the leaders are younger than the wash, which, however, they never penetrate. It is unanimously acknowledged on the field that these leaders never carry gold except on the cracks within a few inches of bottom, as is the case to a lesser extent with the bedrock itself.

There are, however, in addition to these intercalated leaders, occasional east and west leaders on vertical cracks, one of which, south-west of the shaft, was said to have carried a little gold in the solid, 2 feet below bottom. None of the quartz carrying gold could be shown me, that seen containing only pyrite, lining cracks.

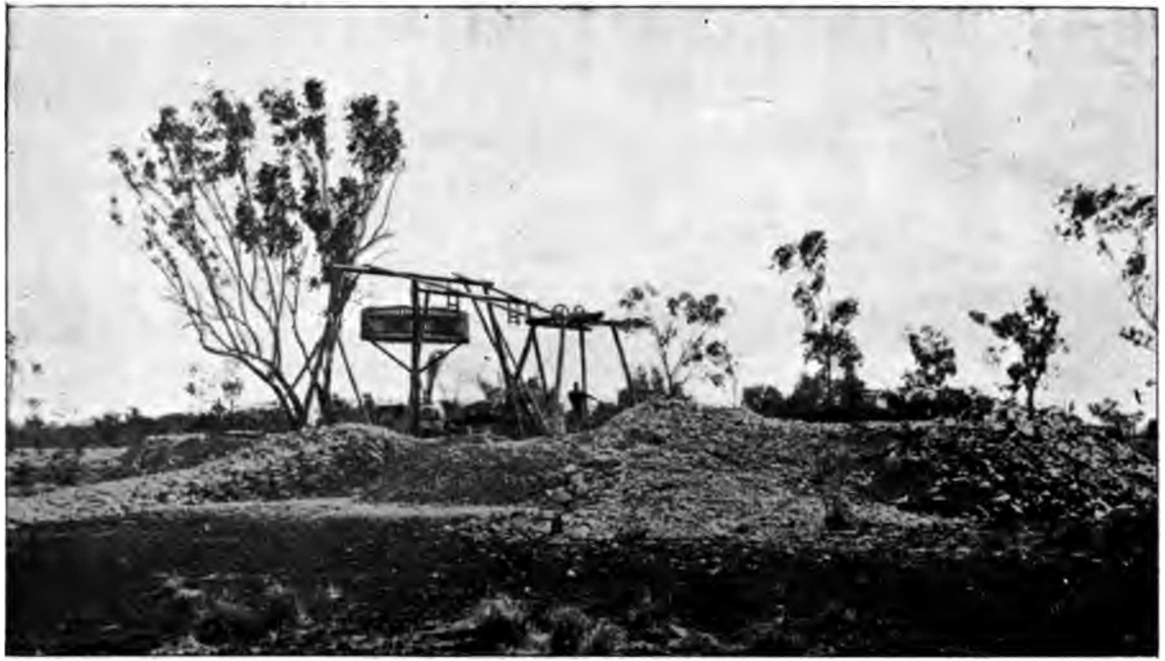

Photo., L.C.B. PENGELLY'S AND YOUNG'S, BLACK RIDGE. **Plate 6.**

SHOWING PADDOCK OF CRUSHING STUFF AND REJECTED BOULDERS.

vi. The practice here has been to break down from 12 inches to ·et 6 inches wash with 6 inches bedrock, though in the eastern e no bedrock is taken, owing to the poverty of the ground. There owever, a distinct improvement in the face 62 feet from the shaft.

The whole of the material crushed previously to September came ı west of the shaft.

vi. The stone crushed does not represent the whole showing in the , for in the first place the larger boulders remain below, and in second a greater or less proportion, according to the poorness or ness of the wash, is thrown out of the paddock by the bracemen. his claim the stones thrown aside at the surface amount to 8 cwt. ›very ton sent to the battery (Plate 6).

vii. The output* comprises:—

1904, Dec.:	**38**	tons for 18 oz.	=	9½ dwt. per ton.
1905, Feb.:	**36½**	tons for 28 oz.	=	15 dwt. per ton.
Mar.:	**76½**	tons for 74 oz.	=	19 dwt. per ton.
May:	**20**	tons (mullock) for 1 oz. 9 dwt.	=	1½ dwt. per ton.
Jun.:	**102½**	tons for 52 oz. 5 dwt.	=	10 dwt. per ton.
July:	**58**	tons (from S.W.) for 31 oz. 15 dwt.	=	11 dwt. per ton.
Aug.:	**58**	tons for 17 oz. 12 dwt.	=	6 dwt. per ton.
Oct.:	**46**	tons for 9 oz. 16 dwt.	=	4 dwt. per ton.

June crushing contained slugs up to 1 oz. in weight. The August hing, according to the *Peak Downs Telegram*, just paid battery claim expenses.

***rseverance*"** (Dequine's)—

i. **Exempt.** **Position:** 7½ chains north-north-west of "Pumpkins."

ii. The shaft is 150 feet deep, and is understood to have reached ·ath the basalt, having been abandoned in clay and sand.

iii. Great trouble was caused by the large quantity of water met —2,000 gallons an hour—causing such a pressure in the loose ›rial under the basalt that 8-inch timbers were crushed. Mr. uine informed me that three distinct water-bearing zones were ›ed in this claim. The first, spongy basalt at 115 feet; the second, ›ed undecomposed basalt at 138 feet; and the third, spongy basalt 50 feet. According to the slope in the "Last Chance," the base of ɔasalt should have been struck at considerably less depth.

***mpkins*"** (Madge's)—

i. **Area:** Six men's ground. Position: 4½ chains west-south-west Bantam."

ii. The shaft is, according to Madge, 218 feet to bedrock, but, rding to others, only 211 feet.

The main drive runs 30 feet north-north-eastwards from the shaft ›e stopes, which extend 25 feet westwards and 80 feet eastwards, widths of 30 feet on the west, 15 feet near the main drive, and eet in the eastern part. The remaining drives include one from the t to the western end of the stopes, a second and third, 20 feet and

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* The Warden's return for 1905 is: 410 tons, £908.

25 feet in length, to the south at the eastern end, and a fourth, extending 60 feet north-north-eastwards, also from the eastern end of the stopes.

The last was being pushed out towards "Bedford's Eastern" shaft ("Last Chance"), but, on account of the long uphill trucking to the "Pumpkins" shaft, the claimholders prefer to work the ground from the "Last Chance."

iii. A small quantity of water (75 gallons a day) makes in the shaft, and it is expected that the northern drive will be flooded by the time connection is made with the "Last Chance."

iv. In the shaft 12 inches of almost barren conglomerate occurs under coal shale, 2 feet 6 inches above bedrock, but this is nearly 5 feet above the main basal auriferous conglomerate. Coaly shale occurs in the strata immediately overlying the wash, and in the north-north-eastern drive from the shaft 2 feet 6 inches of tish, with shale bands, has been exposed beneath the coaly shale.

The wash is of a bluish colour, but much of it has a slight coating of red oxide of iron.

The run of gold worked is believed to be the southern "Bantam," the northern run of the "Bantam" being presumably between the "Pumpkins" and "Last Chance."

It is understood that the western, northern, and eastern faces of the stopes are not rich, but they have not been properly prospected by driving. The southern and northern drives were put in to prospect the ground, but cannot be considered to have served the purpose, though gold has been found in the faces. In the former the lower 6 inches of wash has been tried in the end only, and in the latter no greater thickness has been tried. Payable gold has now been found in the northern drive, 40 feet from the stope.

South of the shaft the bottom seems to be sloping south-eastwards, while the coal measures dip south-westwards. The general slope of bottom is north-eastwards at about 15°, but in the eastern workings it is more nearly eastwards, and is as much as 1 in 2. In the face of the northern drive it is, however, 1 in 10 to the north-east.

v. The bedrock is schist, foliated and quartz-veined parallel to the bottom. The quartz veins are never auriferous, but, like the pebbles of the wash, are sometimes slightly iron-stained.

vi. The amount of wash broken down for treatment has varied from less than a foot to 6 feet (in the eastern stope). In one or two places 12 or 15 inches of wash on bottom, being almost barren, was left untouched, while that above was removed.

vii. Output[*]:—

Warden's total for 1904 : 97 tons for 307 oz. = 3 oz. 3 dwt. per ton.
Feb., 1905 : 45½ tons for 51 oz. = 1 oz. 1 dwt. per ton.
P.D. Tele., **Apr., 1905 : 62 tons for 33 oz. = 11 dwt. per ton.**
July, 1905 : 59 tons for 30 oz. 16 dwt. = 10½ dwt. per ton.
Sept., 1905 : 27 tons for 22 oz. 6 dwt. = 16½ dwt. per ton.

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[*] **Warden's total (?) for 1905 : 230 tons for 163 oz. 0 dwt. 6 gr.**

"*Rejected*" (Moor's or "Dee")—

i. Position: 2 chains south of "Pumpkins."

ii. The shaft bottomed at 221 feet. A drive was first opened about 20 feet to the south-east, rising in the face about 18 inches above the shaft bottom. Another was then carried north-west for 12 feet on the level; then 15 feet, rising 1 in 5; and then 10 feet, rising 1 in 3.

The party now intends to break through to Madge's old stopes, working on both claims.

iii. Water was struck in the shaft at 166 feet depth, but there is none in the tish.

iv. The sinking included:—Basalt, 80 feet; various sediments, 110 feet; quartzite wash (carrying 1 gr. to the dish), 2 feet; sediments, 8 feet; "drift wash" (carrying ½ to 1½ gr. to dish), 4 feet; tish (schist and quartz fragments and pebbles, with only fine colours of gold), 21 feet.

Both the quartzite wash and "drift wash" carried gold, the latter being the richer. A heap containing about 5 cwt. of stone, said to have come from the former, lay on the brace; from it 18 gr. of gold had been dry-blown, and it was expected that almost as much more would be obtained after crushing it, in which case the contents would be 5 dwt. per ton. The occurrence of gold in these layers may have a connection with the fault at the shaft bottom. In case of the wash on bedrock proving unpayable, it is intended to go up the shaft and try these layers.*

At the shaft bottom is a pug seam, 1 inch thick, separating the tish from the bedrock, the surface of which is quite glossy, proving it to be a fault plane. The fault dips 1 in 6 to the south-south-west at the shaft, but within 10 feet to the north-east it suddenly rises and passes into the reef at an angle of 1 in 1.

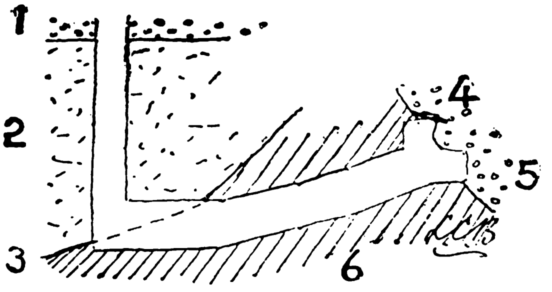

FIG. 4.—SECTION ON NORTHERN DRIVE, "REJECTED," BLACK RIDGE.

Scale: 20 ft to an inch.

1. Sedimentaries.
2. "Tish."
3. Fault.
4. Sediment.
5. Wash.
6. Schist.

In the end of the northern drive bluish cement, containing water-worn quartz with red iron stains, underlying a bluish sediment, and overlying tish (?), has been broken into. This lies on an unslicke sided sidling, sloping 50° to the north-north-east, and for 18 inch from the schist has been proved to be slightly auriferous (1 to 2 gr. the dish), and a 1-dwt. speck has been found. The miners, howev do not expect the wash to be rich on such a steep sidling—payal gold, in fact, not being expected much above the level of that in " Pumpkins." (*See* Fig. 4.)

---

* Warden's return for 1905 is: 30 tons for 45 oz. 6 dwt.

"*Rip and Tear*"—(Lloydstrom's)—

i. Area: Six men's ground. Exempt. Position: 8 chains no west by west of "Pumpkins."

ii. The shaft, in May, 1905, was reported to be 115 feet deep.

iii. The shaft was abandoned while still in basalt, owing to excessive quantity of water met with (1,500 gallons per hour), an now used as a stock well.

"*Ruby*" (Wyles)—

i. Area: Six men's ground. Exempt. Position: 12½ chains no west of "Pumpkins."

ii. The shaft is now 117 feet deep, and had to be abando because the water proved too strong.

iii. In February, 1905, the water, flowing into the shaft at 95 f depth, amounted to 120 gallons per nine minutes.

iv. The sinking appears, to judge by the tip, to have been first dense basalt, and then in vesicular and somewhat decomposed basa with a slight development of amygdaloids.

"*Southern Cross*" (Connorty's, Smith's, and Topham's)—

i. Area: Six men's ground. Position: 13½ chains north-west of t "Pumpkins."

ii. The shaft, now inaccessible, is 228 feet deep (bedrock 220 feet). At 200 feet depth the sinking was by pickwork. A dri was carried 35 feet (?) north-easterly to the dip, on to a terrace 10 fe below the shaft.

iii. No water was met in sinking.

iv. There is no coaly shale above the wash in the shaft.

Colours of gold were found in July, 1905, but there seems to ha been little or no wash, and, to judge from the stone on the tip, wo must have stopped in a brownish "tish."

A high "bar" lies to the west of the shaft.

"*Star of the South*" (Voinech's)—

i. Position: 6½ chains south of "Pumpkins."

ii. The shaft is now (September, 1905) 75 feet deep.

iv. It is still in basalt, weathering into rounded boulders whi give much trouble in shooting.

"*Try Again*" (Bedford's New)—

i. Position: 8½ chains south-west of "Pumpkins."

ii. The shaft is now (September, 1905) a little over 100 feet deep.

iii. Water was struck (a few gallons an hour) just before I left the field.

iv. The sinking near the surface was in vesicular basalt; below that in shaly basalt, passing downwards gradually at about 50 feet into the solid undecomposed rock.

"*True Blue*" (Fraser's)—

i. Position: 2½ chains south-west of the "Nipper."

ii. The shaft is 235 feet deep, bedrock being at 223 feet. The sinking took three months' time, and entailed an expenditure per man of £16, besides labour.

The old workings (now abandoned) run 30 feet to the south-east, being 25 feet across in the face (to be worked in the future); and from there a 60-feet drive connects with the "Nipper" working for ventilation. The new workings are on the "Eldorado" boundary, 130 feet west-south-west of the shaft, with which they connected by a drive. On the north they are 20 feet in width, but 65 feet to the south; the present face is 60 feet long. There is another small stope, 30 feet wide and 40 feet long, on the western drive near the shaft. Further work will be done along this drive, where good prospects have been obtained.

iii. No water.

iv. A coaly band occurs in the wash 2 feet above bottom in the western drive, and the gold is believed to be above it. A sandy shale, with thin lines of coal, about 6 inches above bottom, besides having gold beneath it, generally acts as a false bottom. In one place in the new face the coaly shale band comes right down on to bedrock, and the wash cuts out, but the 4 or 5 inches of schist below bottom carries very good gold, and gold was found in the wash when the shale rose again.

Among the rejected boulders can be detected tish, spotted schist, and quartz (amounting to only 2½ per cent. at most), the average size being 9 inches length and 6 inches across.

The "Nipper" run of gold is expected to be cut by working easterly from the old workings.

The slope of bottom was as much as 1 in 10 to the north-north-west (in the old workings), and 1 in 15 to the west-north-west (in the new workings).

v. The bedrock is thick-bedded, slaty schist, dipping 45° to 50° to the north-west. In the old stope, 40 feet to the south-east of the shaft, the bedrock has suffered disturbance since the solidification of the wash. Incipient faulting, with considerable contortion of the schist and disturbance of the bottom, has occurred, causing "dig" in places. (*See* Fig. 5.) The fault dips 50° to the west-north-west. In the new workings the bottom has in one place been much contorted, broken up, and, for about a foot beneath the wash, veined with lenticules of quartz. It is due to crushing having taken place since the solidification of the wash, and the lenticular veinlets of quartz have been developed since the crushing of the slates.

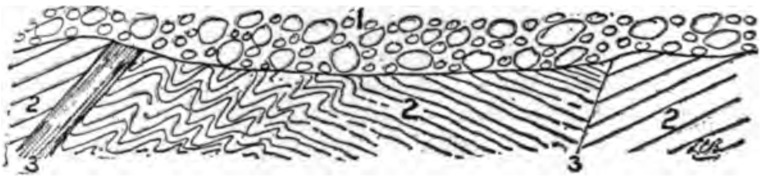

FIG. 5.—FAULT IN "TRUE BLUE," BLACK RIDGE.
Scale: 40 ft. to an inch.

1. Wash.
2. Schists
3. Faults.

vi. The thicknesses broken down are: 18 inches wash and 3 inches solid bedrock in the old workings south-east of the shaft. In the new workings up to 18 inches is rich in gold, and 2 feet of wash is taken, when there is a slickensided sediment above (forming a good roof); 6 or 8 inches of softened bedrock is generally taken, though of the harder rock sometimes only 1 or 2 inches.

vii. Output*: —

1904, Feb.: 50 tons for 42 oz. = 17 dwt. per ton (S. of shaft).
Mar.: 56 tons for 46½ oz. = 16 dwt. per ton (S.W. of shaft).
May: 76 tons for 53 oz. = 14 dwt. per ton (W. and S.W. of shaft).
Sep.: 81 tons for 49 oz. = 12¼ dwt. per ton (drive to "Nipper").
76 tons for 125 oz. = 1 oz. 13 dwt. per ton.
Dec.: 68 tons for 154 oz. = 2 oz. 5 dwt. per ton.

Warden's total for 1904: $400\frac{1}{20}$ tons for 460 oz. 12 dwt. = 1 oz. 3 dwt. per ton.
1905, Jun.: 196 tons for 281½ oz. = 1 oz. 9 dwt. per ton.
July: 68 tons for 80½ oz. = 1 oz. 4 dwt. per ton.
Sep.: 119 tons for 122 oz. 13 dwt. = 1 oz. 1 dwt. per ton.
Oct.: 78 tons for 42 oz. = 11 dwt. per ton.

"*Waratah*" (Ford's)—

i. Exempt. Position: 8 chains south of "Nipper."

ii. The shaft is 208 feet deep, and there is a 30-feet drive. Inaccessible.

iii. Some water was met in sinking.

iv. Only occasional prospects were found in the wash, of which 8 inches was tried.

vii. No crushings. Dry-blowing headings (September, 1905).

2. OLD CRICKET GROUND.

Several claims are working, but the ground is understood to be getting cut out.

"*Dan Carroll's*"—

ii. Driving eastwards.

---

* Warden's total for 1905 is: 624 tons for 660 oz.

iv. Good gold. One 19½-dwt. "speck," which still contained a small proportion of attached quartz, was shown me. Such specimens are characteristic of the Cricket Ground, while towards Daintree's Knob the gold is much finer.

3. HILLSIDE CLAIMS.

"*McCallum's*" (or Ford's)—

i. Abandoned. Position: 4 chains north 162° east from the Black Ridge Hotel.

ii. The shaft is 145 feet deep. Much work has been done in this claim during the past year.

The mine is now again idle, because of the faces becoming poor, but payable ground is expected on opening out, say towards the "Fraud."

vii. Output:—

Probably 350 tons washed for yields up to 16 dwt.

"*Moxham's Leap*"—

i. Position: 19 chains north-north-east of the "Nipper."

ii. The shaft is 185 feet deep.

vii. Output: The first load was washed for 11 dwt., and several loads were washed for 5 to 7 dwt. These had to be troughed and broken with a beater. No wash has been raised since the above, but the headings were being dry blown in September, 1905.

4. BLUE GROUND.

The latest developments have been along Gowrie Creek, on part of the old Blue Ground, which at the time of my last visit was untried. Some six claims have been taken up in a line running towards Daintree's Knob. They have brought to light an extensive fault, which I was able to inspect in "Edwards and Ford's" claim.

It is said that the east and west trails which were followed in the Red Ground broke up in the Blue Ground on passing beneath Gowrie Creek, as at the Wild Cat and Deep Creek (McDonald's Flat).

"*Williamson's*" (and Fogarty's)—

i. Position: 3 chains north-north-east of the Billiard Saloon.

iv. Fair prospects.

"*Donaldson's*"—

i. Position: 1½ chains east of the Billiard Saloon, on Gowrie Creek.

ii. The shaft is 95 feet deep.

"*Maisey's*"—

i. Position: 5 chains south-east of Donaldson's.

iv. The sinking included 16 feet of billy. The workings are believed to be on a separate trail to "Edward's and Ford's," described below.

vii. Output (among others):—

Aug., 1905: 16 loads puddled for 8 oz. 9 dwt. = 10½ dwt. per load.

"*Popplewell's*"—

i. Position: 5 chains south-east of the New Bakery.

ii. The shaft is 115 (?) feet deep.

iv. The wash here, being cemented, has to be crushed.

vii. Output:—

July, 1905: 23 tons = 21 dwt. per ton.
Aug., 1905: 45 tons for 80 oz. = 38 dwt. per ton.

"*Edward's and Ford's*"—

i. Position: About 5 chains south 10° degrees east of the New Bakery.

ii. The shaft is 111 feet deep to bedrock, and 5 feet 6 inches into bedrock. A drive runs west for 20 feet in hard, rather sandy, barren blue cement. A few tons have been removed on the northern side of the shaft. A drive (50 feet long in September, 1905) is now being carried out to the east-south-east from it at 20 feet from the shaft, a cross-drive runs 10 feet to the north, and a branch from the end runs back 10 feet towards the shaft.

iv. The sinking comprised: Clay, 10 feet; billy, 10 feet 6 inches; billy sand (with holes, one 20 feet long, 4 feet high, and 18 inches wide, with jagged and loose stones on the sides), 6 feet; soft sands, 25 feet; and conglomerate, to 111 feet. The eastern drive is in schist for 20 feet from the shaft, when it enters wash overlaid by schist. This is due to a fault running south 10° east, and dipping westwards 1 in 2 (?), causing an upthrow of some 12 feet on the west. (*See* Fig. 6.) The slope of bottom is 1 in 20 to the north-west. The plane of the fault is not slickensided, but the laminated schist has been broken up into a kind of puggy tish for from 18 inches to 2 feet from it. The fault has been found in other claims for 5 chains to the south 10° east.

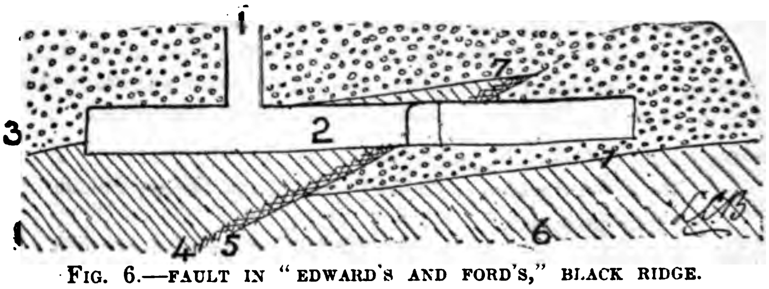

FIG. 6.—FAULT IN "EDWARD'S AND FORD'S," BLACK RIDGE.

Scale: 25 ft. to an inch.

1. Shaft.
2. Drive.
3. Wash.
4. Tish.
5. Fault.
6. Schists.
7. Gold.

A little gold, but unpayable, is found on the fault; ½ to 2 gr. to the dish is found on the (upper) bottom west of the fault, but none near the fault on (the lower) bottom east of it. At 30 feet east of the fault, however, gold is being got on bottom, and is expected to increase eastwards.

v. Bedrock is bluish schist, the laminæ of which dip steeply eastwards.

vii. The tenor of the wash has not yet warranted a crushing.

5. Daintree's Knob.

"Carroll's"—

ii. A face now being cleaned up is expected to run 15 dwt. per ton.

vii. Hickey's crushing, given by the Warden as from Mason's (Bedford's old), on the Deep Ground, is from this claim.

"Monahan's"—

i. At head of Gowrie Creek.

ii. The shaft is 136 feet deep.

vii. Output:—

May, 1905: 23 tons for 11 oz. = 9½ dwt. per ton.

IV. MICLERE CLAIMS.

Population: Between 1891 and 1895 there were nearly 400 men at the Miclere; at present, on the Tish Ground, there are six men, and on Boulder Gully the same number. The total at Miclere is now between fifty and sixty men.

Cracks in bedrock are reported to be often gaping when first exposed in the old workings.

"Smither's and Barker's"—

i. The shaft lies a few chains west of Palmer's and Reid's.

ii. The shaft is 63 feet deep, and was abandoned soon after sinking, through flooding from the old workings.

iv. A fault lined with ½-inch pug in the wash and schist here runs south 10° degrees east, dipping 80° to the west. It is reported that in some of the claims the western side has been thrown up 28 feet, so that there is an overhanging ledge of bedrock. (*See* Fig. 7.)

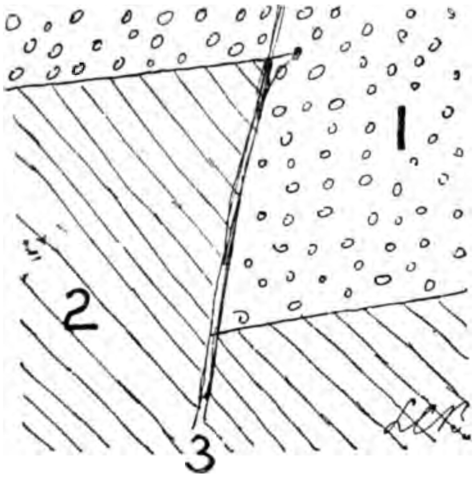

FIG. 7.—FAULT IN "SMITHER'S AND BAKER'S," MICLERE

Scale: 20 ft. to an inch.

1. Wash.
2. Schist.
3. Fault.

Good gold has been found all along this fault (the ground elsewhere being patchy) for 5 or 6 feet from bottom; and "colours" have been found right to the surface.

There is no pug on bottom.

vii. Output:—100 oz. of gold were obtained from 5 bucketsful of dirt from along the fissure.

1. "TISH" GROUND (COAL MEASURES).

"*Palmer's and Reid's*" (Gillespie's Old)—

i. Position: 1 chain north of Madge's, and east-south-east of the Post Office.

ii. The shaft is 91 feet deep, and, as only just unwatered, it was not inspected. The solid ground on the north-eastern side of Madge's worked ground is being tried, but none has been taken out yet.

iv. The slope is about 1 in 20 to the south-west.

"*Roper's*"—

i. Position: Two shafts (now filled in), one on each side of the road (and about 10 chains apart), 1½ miles south of the Miclere.

ii. The eastern shaft is 75 feet deep, sunk in loose white quartz conglomerate, beneath pebbly surface, with billy caps. The western shaft is 80 feet deep in white conglomerate and sandstone.

iv. Neither shaft bottomed, work being abandoned as soon as the country became too hard for picking.

2. BOULDER GULLY.

Gold is now being found in "dabs" in clay, under billy boulders, at 6 feet below the surface.

Two shafts bottomed on schist at 60 and 90 feet, but the wash carried only colours of gold.

24th October, 1905.

Appendix.

The following references to gold-bearing conglomerates have (except those of New South Wales and Queensland) been extracted from Beck's and Weed's " Nature of Ore Deposits" just to hand. They show that the Black Ridge deposits are not unique in form, and that the theory of origin offered above has been already proposed elsewhere.

Black Hills, Dakota.*—" Cement deposits (3 to 4 feet of rounded waterworn fragments of schist) of the basal conglomerates of the Cambrian beds, resting directly upon upturned schists." The gold is rounded, and the greater part is derived from the Homestake lode, but films between the fracture planes of the schist are due to enrichment by ferric sulphate solutions and to the introduction of pyrite following rhyolite intrusions.

Gulgong, N.S.W.†—" Detrital gold in payable quantities" in conglomerates forming the basal beds of the Upper Coal Measures (Permo-Carboniferous)—1 to 15 dwt. gold per ton. " Doubtful whether this deposit forms a definite alluvial lead." "The conglomerates were, doubtless, deposited in an estuary, and it is probable that the auriferous portions of them were laid down along the shore line which received the surface drainage from some old auriferous rocks, and that the gold derived from the denudation of the latter was thus distributed amongst the pebbles."

Mount Brown, N.S.W.†—A lead composed chiefly of waterworn white quartz lies on Silurian rocks, and is found to dip beneath the surface of the plain, which is formed of Desert Sandstone (U. Cretaceous). Some very rich patches of gold.

Drake, N.S.W.†—The conglomerates forming the base of the Clarence River Coal Measures (Triassic) contain detrital gold, though not in payable amount.

Hobart, Tas.—Gold has been found in the Coal Measures here.

Corbett's Mills, Nova Scotia.—Rounded gold grains in Carboniferous conglomerate traversed by gold-quartz strings.

Bessèges, France.—Gold has been extracted from Lower Carboniferous conglomerate.

Placer Co., California.‡—Auriferous Jurassic conglomerates, finely divided gold with some pyrite, possibly due to later impregnation.

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* Papers by W. B. Devereux and F. C. Smith in Trans. Am. Inst. Min. Eng., and official reports by J. D. Irving and S. F. Emmons of the U.S. Geol. Survey.

† Edward F. Pittman: "Min. Resources of N.S.W."

‡ Lindgren: Am. Jour. Sci.

Northern California.—Gold-bearing Mesozoic conglomerate of marine origin.

Otago, Nelson, and *Southerland,* N.Z.*—Auriferous deposits of Cretaceous age.

Ipswich, Q.—Mr. Cameron, of this Survey, informs me that there have been reports of gold occurring in the basal beds of the Ipswich (Trias-Jura) Coal Measures.

Callide, Q.—Gold occurs in the fine-grained basal conglomerates of the Callide (Trias-Jura) Coal Measures, and a little prospecting has been done on Kelly's Gully for, however, very poor returns. The conglomerates are many feet in thickness, and gold appears to have been found at various horizons in them. Basalt occurs in the vicinity sometimes abutting against the conglomerates, and may have been connected with the introduction of the gold. Further prospecting is likely to be done here.

Palmer Goldfield, Q.†—"Payable gold has been obtained in consolidated drifts or 'cements' between the base of the Desert Sandstone (U. Cretaceous) and the surface of the slates, to the north of the Palmer."

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* H. A. Gordon : Trans. Am. Inst. Min. Eng.

† R. L. Jack : "Geology of Queensland."

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Queensland.

DEPARTMENT OF MINES.

Geological Survey of Queensland.

PUBLICATION No. 202.

SOME

CROYDON GOLD MINES

WITH 14 PLANS AND 12 PLATES.

BY

B. DUNSTAN, F.G.S.,
ACTING GOVERNMENT GEOLOGIST.

BRISBANE:
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SOME CROYDON GOLD MINES.

◆

INTRODUCTION.

In making a detailed investigation of the geological and mineral features associated with the Golden Gate line of reef on the Croydon Goldfield, the special objects in view were to inquire into the probability of finding gold in various places along the line of reef, and to advise those interested on the prospects of striking gold-bearing reefs if sinking were continued to greater depths. The results of this work, together with a large number of plans of the mines on the Golden Gate reef, are given in the present report.

A prior report on the Croydon Goldfield, by Mr. W. H. Rands, was published by the Geological Survey Office in 1896, and will be found to contain a large amount of useful information on gold-mining at Croydon up to that time. It also gives an outline of the known geological formations, and of the gold-prospecting operations in the surrounding country.*

Golden Gate township is situated about four miles from Croydon, in a north-westerly direction, the position of Croydon being Lat. 18° 12′ 13″ south, and Long. 142° 14′ 58″ east.

Croydon and Golden Gate are on the extreme eastern edge of the vast plain extending towards the Gulf of Carpentaria and the western boundary of Queensland, the country to the east being hilly and mountainous, and extending uninterruptedly in this direction for many miles.

The streams which have their source in the Croydon district fall either westerly or northerly. Some of those trending westerly rise in the hills immediately to the north of Croydon, while others rise in the low granite country to the east of Croydon, all disappearing in the western plains, the porous rocks of which form the intake beds of the artesian series belonging to the Cretaceous System. The watercourses flowing northerly have their source also in the hilly country, but are some distance further north from Croydon than those trending westerly, and they fall into the Carron River, a branch of the Norman River.

Timber does not grow well in the Croydon district, and for mining, as well as for domestic purposes, localities on the Croydon-Normanton railway line have to be depended upon for the requisite supply.

---

* Report on the Croydon Goldfield. W. H. R. By Auth.: Brisb.: 1896. Pp 66, 3 maps, and 11 plates. (G.S.Q.P., No. 118.)

Golden Gate lies at the base of the very gentle westerly slopes of a series of hills from one to three miles distant. The principal elevation is Black Mountain, which lies about three miles to the west of the Golden Gate Railway Station, and has an altitude of 724 feet. Cuthbert Hill is the name here given to the conspicuous feature in the landscape east of the main road between Golden Gate and Croydon, and on the north side of Belmore or Station Creek. Double Peak lies to the north of Black Mountain, and about east of the Golden Gate township. Plant's Hill is the name given to the elevation between Double Creek and Golden Gate, the deep shaft, known as Plant's shaft, being sunk at the bottom of the slope leading down from it.

Robinson's Hill is a prominence north-east of the Golden Gate, and is about a mile and a-half distant. Two other small hillocks, about a mile west of Robinson's Hill, and about the same distance northerly from Golden Gate, have been called "Felsite Knobs." The exact position of these landscape features, together with their altitudes and configuration, are shown on the accompanying plan (No. 1), on a scale of ten chains to an inch.

The principal stream at Golden Gate is Belmore (or Station) Creek, the main heads of which have their source several miles away to the north-east of Croydon. Golden Gate Creek is a small watercourse on the north end of Golden Gate, while another watercourse, called Rogers' Gully, which takes its rise at Double Peak, has a south-west course, and disappears in the flat country to the west of the railway line.

GENERAL GEOLOGICAL FEATURES.

The topographical features and geological formations at Croydon and Golden Gate have been proved to bear a direct relation to one another, the hills being composed of felsite and quartz felsite, while the flat country, which forms the covering of a large area of granite, consists of horizontally bedded and undisturbed conglomerates, ferruginous sandstones, and cements.

Below the conglomerates and sandstones the granite is to be found all over the Croydon Goldfield, but in no place have the sedimentary rocks been observed having a thickness greater than twenty feet. Away from the hilly felsite country, very probably the depth at which the granite occurs will be greater as the distance therefrom increases, with, of course, a corresponding increase in the thickness of the sandstones and conglomerates.

FELSITES.

The felsites are conspicuous rocks in the mountainous country to the north-east of Croydon and Golden Gate, but they are absent from the low country, where the granites occasionally outcrop above the

PLATE I

Diagramatic Sections

Illustrating the successive movements in the faulting of the Gate Reef West of the V. Shaft in the G.G.4 & 5 S. Block & near the boundary of the Nº 3 & 4 S.

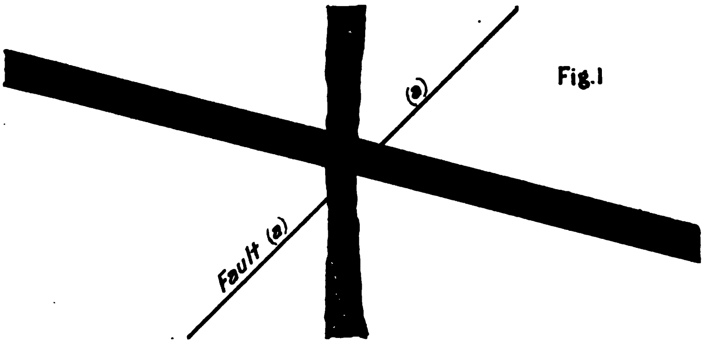


Fig. 1

Joint Plane *(a)* passing through Reef and Dyke

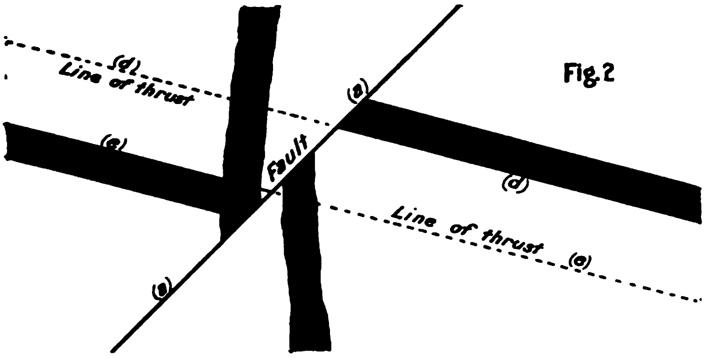


Fig. 2

Normal faulting along the Plane *(a)*

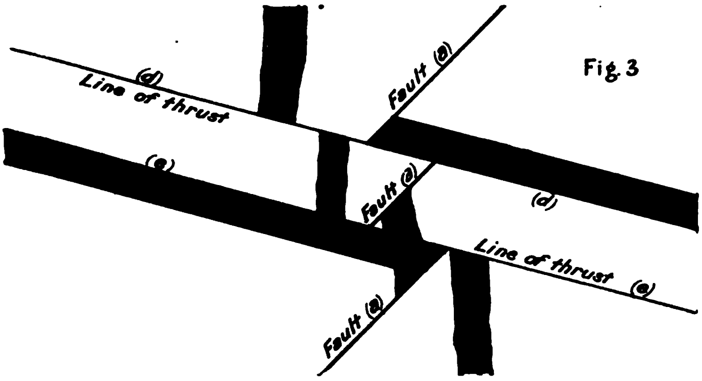


Fig. 3

Reversed faulting, or thrust, along the two Planes *(d)* & *(e)*

(Illustrating Report on "Some Croydon Gold Mines")

horizontally-bedded sandstones and conglomerates. Some of the felsites and quartz-felsites merge into a fine-grained porphyrite, while others, from the alteration which they have undergone, are of indefinite composition. This is particularly noticeable close to the junction of the felsites and granite, where a zone of alteration exists, and where the rocks vary much in character. The replacement of some of the minerals with silica, and the alteration of the felspars to kaolin, and of the ferro-magnesian to chloritic and serpentinous matter, makes the microscopic examination of the rocks one of uncertainty.

In the following pages they will be referred to generally as felsites, and may be identified in the field as bluish fine-grained rocks, and which on the surface are sometimes decomposed to a whitish or reddish rock resembling a fine-grained sandstone. Occasionally large blebs of quartz occur in the felsites, but usually they are without these inclusions. Graphite (plumbago) is found disseminated through the felsite, but the amount is exceedingly small, although the quality of the mineral is very pure.

The occurrence of the felsites, more or less altered or decomposed, has been observed in many localities in the district, but conspicuously are they to be seen at the Felsite Knobs, Robinson's Hill, Double Peak, Cuthbert Hill, and Black Mountain. (*See* Plan 1.) In the immediate vicinity of Golden Gate the reefs in the felsites are not productive, but some miles distant from their junction with the granite they have proved in places to be very richly impregnated with gold.

Dykes of felsite have been observed in the granite forming the walls of the Golden Gate Reef, where their presence was considered to influence the occurrence of the gold in the quartz. Nothing, however, was seen to warrant this conclusion being drawn.

A vertical section across the hills and flat country is represented on Plate 12, and shows the relation of the felsite to the granite. From the evidence obtained it would appear that the granite underlies the felsite, and that the former rock is dipping easterly under the felsite hills.

GRANITES.

The granites are confined to the low country, where they are exposed cropping up above the horizontally-bedded sandstones and conglomerates, and also in the watercourses which have cut a channel through the latter rocks. Wherever found, even at a depth of over 1,300 feet from the surface, they are altered, the ferro-magnesian constituent seldom being recognisable.

In the field they are observed as close-grained rocks, generally with a pink or grey felspar and limpid quartz, and containing a dark-greenish product resulting from the alteration of hornblende or mica.

Inclusions of graphite are common, but this mineral in the granites, unlike that in the felsites, is very impure, and is mixed with much quartz. The alterations of the original constituents of the granite have produced several secondary minerals, those most noticeable being greenish-yellow serpentinous matter, a white flaky calcite, a whitish or pink fluorspar, and a brown siderite; while impregnations of mineral solutions have resulted in the formation in the rocks of iron pyrites, copper pyrites, galena, and arsenical pyrites in small quantities.

The general mining development along the line of the Golden Gate Reef indicates the division of the granite into more or less defined belts, depending on the absence or presence of graphite. Another division may be distinguished by the texture of the mineral constituents, fine and coarse varieties occurring along certain zones. The coarse variety is usually taken to be an intrusive dyke, but the large area of this rock, both at Golden Gate and at Croydon, and also in the country to the south-east at Croydon King, and to the east-south-east about sixteen miles at Stanhills, is not suggestive of the rock being an intrusive mass in the finer-grained granites. It would be more reasonable to suppose that the coarse and fine granites are simply alternating masses or belts, and belong to the same general series.

The presence of the graphite in the granite has produced lines of weakness in the country in which it occurs, and very probably the action of the graphite in reducing friction, and in allowing lateral rock movements to take place with comparative ease, has been the primary cause of the flat angle of inclination which the Golden Gate Reef possesses. In the felsite country, where the graphite is only in minute quantities, the reefs are nearly vertical, and show an absence of the complicated movements which form so prominent a feature in the graphite-bearing granites at Golden Gate.

The coarse-grained granites occur in several places on the field, but at the No. 1-and-2 South Golden Gate the granite is identical with that occurring at the mine known as the "Rip and Tear," between Croydon and Golden Gate, where the rock is generally considered to be a type of intrusive granite. At the No. 1-and-2 Golden Gate, there is no appearance of this rock being intrusive, and it gradually merges into another, in which the mineral constituents are finer grained. The rock contains felspar (partly kaolinsed), quartz (very free from inclusions), and altered biotite mica. Portions of the altered rock show a cryptocrystalline deposit of silica as an accessory constituent.

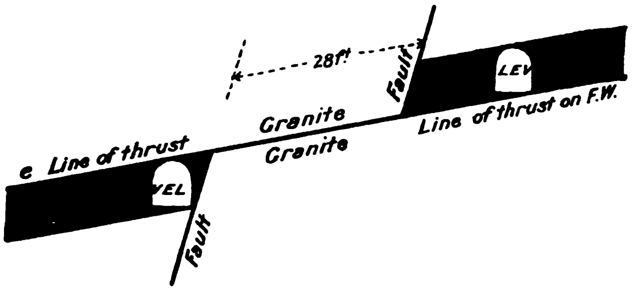
The normal variety of granite on the field is a medium-grained rock, and that found at Plant's shaft may be taken as a type. In every respect, however, its mineral constituents are similar to the coarse-grained variety at No. 1-and-2 South Golden Gate.

Fine-grained granite is found in various parts of the field, but occurs noticeably on the north end of the line of reef. It is closely

PLATE 2

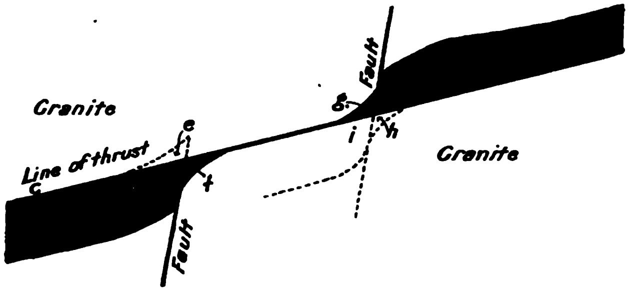
Fault Sections
in
Golden Gate 4 & 5 S. Block ('98)

Fig. 1



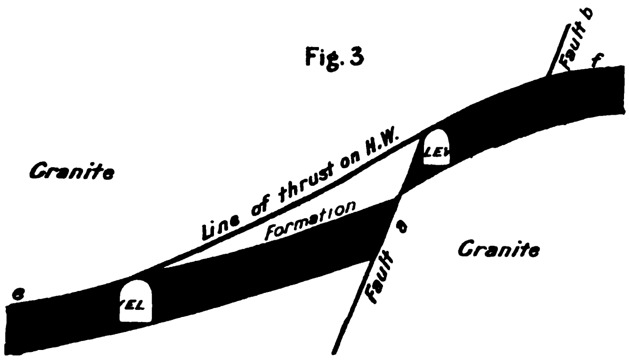
Section in Winze between 2 & 3 N. Levels

Fig. 2



Section in Winze between 1 & 2 S. Levels

Fig. 3



Section in Underlie Shaft
(near No 2 Level)

(Illustrating Report on "Some Croydon Gold Mines")

associated with a fine-grained binary granite, in which hornblende and mica are very rare. This latter type of rock, with another of much coarser texture, but of similar composition, also occurs in the zone of disturbance between the granite and felsite country.

INTRUSIVE ROCKS.

Dykes of (?) dolorite occur in several of the mines along the Golden Gate Reef, and during the plotting of dykes on a general plan subsequent to the examination of the underground workings, it was found that they extend all along the line of reef, and are nearly all connected with one another. (This is shown on the general plan, No. 1, and with greater detail on Plan 2, Sheet 2.)

The rock is much decomposed, and no specimens were obtained sufficiently fresh for purposes of determination. Amongst the miners the dykes are known as "clay heads," but much confusion exists regarding their origin, as it is not clearly understood that all "clay head" have not been intrusive rocks. In some of the mines the clay has been filled into joints from above, and is not the decomposition product of a dyke rock, *in situ*: on the other hand, many "clay heads" are unquestionably dykes which are more or less decomposed.

The dykes vary from a few inches to several feet in thickness; one near Ryan's No. 12 South is said to be twenty feet from wall to wall, while others exist not more than two inches thick. On several of the accompanying plans and plates, vertical sections are given of the dykes associated with the reefs where mining operations have exposed them, and other plans show their general trend and position.

It has been considered that the presence of the dykes influences the gold-bearing quality of the reefs with which they are in contact, and some miners are of the opinion that the effect is to make a reef rich on one side of a dyke and poor on the other. The dykes, however, cannot have any possible bearing on the occurrence of the gold, as they were intruded after the reefs were formed. Illustrations of this will be seen in some of the sections in the accompanying plans and plates.

Plans 1 and 2 show the general trend of the dykes on the surface throughout the field. Plan 8 shows the dyke intrusion in Roger's No. 1, west of the 120-ft. vertical shaft, and Plan No. 9 illustrates a section of the same dyke in No. 6 shaft, and also a section of what is probably a fault in the 120-ft. shaft (in the Golden Gate United) east of the No. 1-and-2 South lease.

The dyke in the disturbed portion of the reef in Viles' underlie is represented on Plan 11. On Plan 12, the dyke in the underlie of No. 9 South is shown in section, also the "clay head," or decomposed dyke, in the workings on the Nancy Lee Reef in No. 9 South Block.

On Plan 13, a section is given of the No. 11 South, where probably a dyke exists to the east of the bottom of the underlie shaft. Plan 14 shows the large dyke at No. 12 South, where the reef is faulted to the west.

On Plate 1 a diagrammatic section of the dyke in the Golden Gate No. 4-and-5 South Block is shown, illustrating the alteration of position by subsequent faulting. Plate 2 shows the dyke in association with faults and overlaps in the workings of No. 5 South, and of the No. 4-and-5 South Block.

Fig. 1, on Plate 5, represents a section in the No. 5 South, where a dyke has been intruded subsequent to the formation of the reef, while Fig. 2 shows a dyke intrusion along a fault plane in Viles' underlie. Plate 10 represents a section in No. 12 South, and illustrates the dyke traversing the fault in that locality.

Fig. 2, page 21, shows a dyke mass disturbed by a subsequent fault in the Golden Gate United, and in Fig. 4, page 27, a section in the same mine shows the irregular character of the dyke in the granite above the reef.

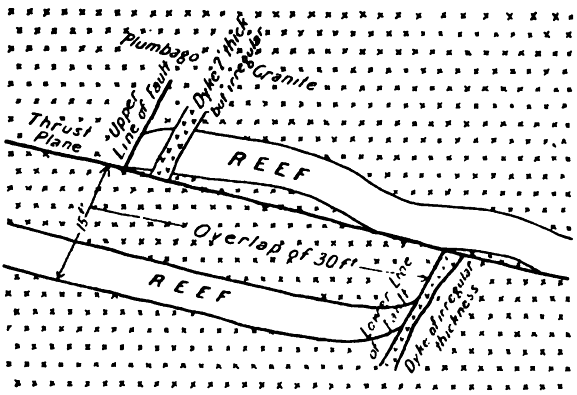
FAULTS.

Faults in the Golden Gate Reef are of common occurrence, and their presence in some of the mines has caused considerable trouble in the methodical working out of the bodies of rich stone which they have disturbed. They have a general north-and-south trend, although varying considerably from this direction, and have a dip, usually nearly vertical, but occasionally parallel with the dip of the reef. In the former case the reef is dislocated by a downthrow, either to the east or to the west, generally the latter when the dislocations are severe and infrequent, and the former when the faults are small but numerous. The faulting along the dip of the reef is not always perceptible, being produced either by the sliding of the hanging-wall over the top of the reef, or by the sliding of the reef along the footwall. The slickensides on the walls, however, are unmistakable proofs of the faulting having taken place. Where the dip fault crosses a vertical fault the behaviour of the two faults is clearly seen.

The dip faults are nearly all thrust faults, and, in some places, cause the reef to separate at right angles to a vertical joint, and thus leave blank portions between the walls; while in other parts parallel with the blank portion of the reef where broken, the thrust faulting produces an overlap; in fact, the operation of thrust faulting, which produces the blank in one part of the reef, also produces the overlap in another portion. Examples of this are shown in the accompanying plans. Plan 8 shows the fault in Rogers' No. 1 (Golden Gate, Limited), and Plan No. 9 the faults in Rogers' No. 1, and No. 1-and-2 South.

Plan 11 shows other faults in No. 9 South; while on Plan 14 a diagrammatic section is given of a fault in the Golden Gate and Nancy Lee Consols (Drawbridge's).

Fig. 1.



SECTION IN ROGERS' No. 1.
(*Showing an Over-thrust where the Reef has been Faulted*).

Plate 1 shows a section illustrating the successive movements in the faulting of the Gate Reef, at a position west of the vertical shaft in the Golden Gate 4-and-5 South Block, and close to the boundary of the 3-and-4 South. On Plate 2 is represented some fault sections in Golden Gate 4-and-5 South Block (".98 "), and Plate 4 shows a section of portion of the workings in No. 5 South and No. 4-and-5 South Block, and illustrates the faults and dykes, and the overlapping of the reef. Plate 5 shows fault sections in No. 5 South and Viles' Block, and on Plate No. 6 there are diagrams illustrating features in the Golden Gate and Nancy Lee Reefs. On Plate 7 a diagrammatic section is shown of the faults in the Golden Gate Reef in the No. 9 underlie, and Fig. 2, Plate 9, represents a section showing the fault (or "break") at the No. 12 South (Ryan's). Plate 10 represents a section along the No. 12 South fault, and shows the position of the fault where it dislocates the reef at this locality. Plate 11 shows a general section at the 18 South Banner, and the disturbance of the reef by a severe fault.

Text Fig. 1, on this page, is a section taken from Rogers' No. 1, illustrating the over-thrust of the reef at a fault. Fig. 2, page 21, and Fig. 3, page 23, are sections of an over-thrust in the Golden Gate United.

SEDIMENTARY ROCKS.

The Sedimentary Rocks around Croydon comprise sandstones, conglomerates, and ironstone cements, and form two distinct, although probably conformable series. The older series consist of fine-grained horizontally-bedded sandstones and conglomerates, containing numerous marine fossil remains belonging to the "Desert Sandstone" (Upper Cretaceous) Formation. The younger series, probably of Teritary Age, comprise deposits of ferruginous cements, sandstones, and conglomerates, which form the flat country extending away to the west of Croydon, and which show evidence of being more recent than the Desert Sandstone Formation. This evidence consists in the exposure of the younger series resting on escarpments of fossil-bearing Desert Sandstone to the north and south of Croydon.

From an economic point of view the two series are of no importance, although in the younger formation a small band of coal occurs near True Blue, between Croydon and Golden Gate. This coal is the variety known as lignite, but it is of inferior quality and quite useless.

At Golden Gate these sedimentary deposits had to be pentrated in some of the shafts before the cap of the reef was met with, and in places the reef has only been found after sinking twenty feet through ferruginous conglomerates and sandstones.

The outcrop of the Gate Reef occurs in very flat country, and the accumulations of these younger deposits have quite obliterated all traces of the reef in many places on the surface. If the deposits had been a few feet thicker or were a few feet higher, the whole line of outcrop of the Golden Gate Reef would have been completely covered, under which circumstances it is very probable that the line of reef would have remained undiscovered at the present day. It shows the possibilities of other reefs existing in the Croydon district, whose outcrops have been submerged by the accumulation of sedimentary deposits over them.

Deposits of recent alluvium have been formed around Golden Gate as a result of the disintegration of the hilly felsite country, but they are confined to the banks and beds of the present watercourses, and are very limited in extent. In places they have been proved to be gold-bearing, but away from the outcrops of the reef they are quite barren.

The history and general geological features of the Croydon Goldfield, as a whole, are given in detail in the report by Mr. W. H. Rands, previously referred to, and as the report is not out of print, no further reference will be made to that portion of the subject.

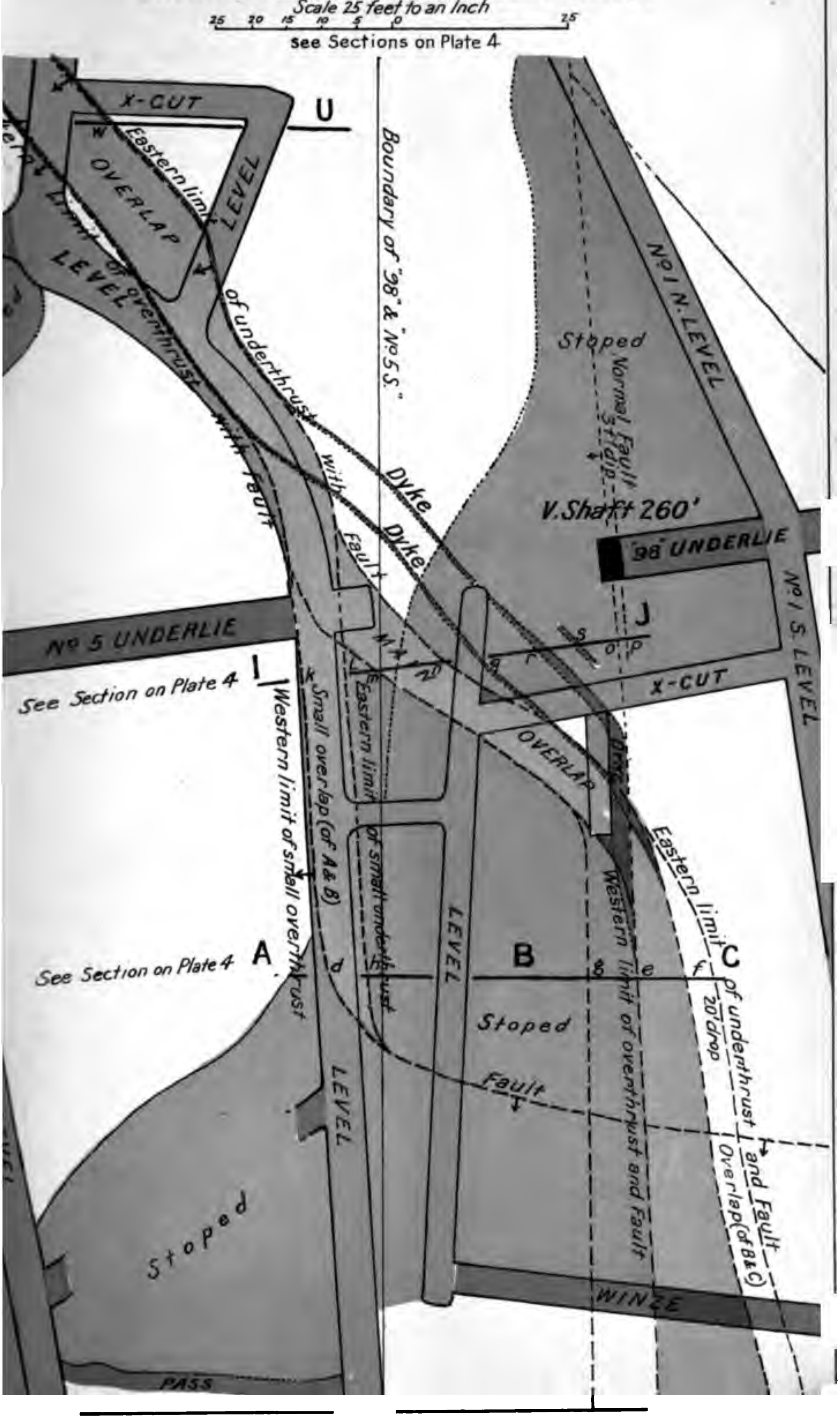
THE GOLDEN GATE.

The general strike of the Golden Gate Reef is about north-north-west and south-south-east, and the dip is about east-north-east, at an angle from the horizontal of about 1 in 3 (18°). The direction of strike varies in different localities, while the dip has considerable variation from the above angle, being sometimes as flat as 1 in 4, or as steep as 1 in 2. The details of the various dips are shown on the accompanying plans and plates.

PLATE 3

Plan of Portions of No. 5S. & No. 4 & 5S. Block

showing Faults, Dykes & Reef overlaps



(Illustrating Report on "Some Croydon Gold Mines")

The thickness of the reef varies from a couple of feet to perhaps over thirty feet, but five or six feet may be considered the average size. The reef usually carries a class of stone which is not gold-bearing, and is known as "buck," although some stone in the reef which is not "buck" also is not gold-bearing. From the evidence which has been obtained these classes of stone—"gold stone," "poor stone," and "buck"—have been formed at two distinct periods. (*See* Plate 6, Fig. 3.) The characters of each are difficult to distinguish, and still more difficult to describe, but in general appearance they all are more or less iron-stained and frequently carry pyrites. The gold-bearing stone in addition carries galena and zinc-blende, and is not so glassy in appearance as the "buck." The portion of the reef which is not "buck," but which is not gold-bearing, is characterised by the absence of galena, this latter mineral being a persistent associate of the gold in the Golden Gate Reef. The galena occurs in extremely fine particles, and where the gold is richest the particles of mineral are so finely disseminated that it gives to the quartz a dark-leaden colour.

Between the walls of the reef a "formation," composed of fragments of country rock, frequently occurs mixed irregularly with the quartz. Sometimes it separates the "buck" from the gold-bearing stone, and as frequently forms a mass on the hanging and foot walls, or else it occurs as bands alternating with "buck" or gold-bearing stone. Occasionally it occupies the whole of the space between the walls, with the exception, perhaps, of a thin seam of quartz on either the top or bottom.

In the Rogers' Extended Block shaft the reef in one place is composed of calcite, this mineral having been found to gradually displace the quartz as the prospecting operations extended into the deeper ground. The calcite crystals found in cavities in this part of the reef have a mineralogical habit not previously recognised, and have been illustrated in the Records, No. 2.*

The rich and poor parts of the Golden Gate Reef have, of course, been a subject for consideration and much discussion on the part of those interested in the development of the mines, and many wild theories have been advanced to account for the presence of the gold. Mining operations have revealed the character of the rich ore bodies, and the recent geological survey carried out has enabled their positions to be fixed and their underground features correlated. The results show that shoots of gold-bearing stone can be distinguished, having a north-easterly dip, but this general feature cannot be relied on as a safe guide in opening up a mine far away from where good stone has been obtained in the same reef.

The accompanying large plan (Map 2, in four sheets), on a scale of 100 feet to the inch, will show, in colour, the country which has been prospected, and that which has been worked out. From this plan, it will be observed, the occurrence of the gold in the reef is by no means uniformly along shoots having a general direction of dip.

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* Queensland Geological Survey. Records, No. 2. By B. D. Bris.: By Auth.: 1905. Page 25, plate 5. (G.S.Q.P., No. 196.)

One noticeable feature concerning the rich parts of the reef, however, is the presence of rich stone where the reef is faulted, or where it takes a sharp fold with a northerly dip, the effect of which has been to throw down the reef on the north side and cause the outcrop of the reef on that side to extend further west of the outcrop on the south side. Where this takes place the reef has been found to be rich on the north side of the fault or fold. To bring about this result a lateral (northerly) movement of the hanging-wall, after faulting, has probably taken place to produce fissures which have been filled with gold-bearing quartz. With a fault dipping to the south, the reef on the south side would be thrown further west than on the north side, and instead of opening a fissure in which the gold-bearing stone would form, the effect, with the same lateral (northerly) thrust, would tend to compress the country rather than open it, so that the accumulation of gold-bearing stone would not take place to the same extent.

The outcrop of the Golden Gate Reef has been clearly defined where most of the mines are situated, but from the evidence of miners, it apparently extends beyond the Golden Gate township for several miles in a north-north-westerly direction, although the absence of payable stone on the surface has not encouraged further prospecting work to be carried out on it.

To the south-south-east of the township, the reef has a branch called the Nancy Lee Reef, but the main reef continues to the railway bridge on Belmore Creek, about one and a-half miles from Golden Gate Railway Station. (*See* Plan 1.) The reef was not examined south of this bridge, but it outcrops further on in this direction, where it is known as the Sunset Reef. Here it is lost against an east-and-west fault, but surface and other features show a possible connection with the Content Reef much further east. The fault in this case produces a downthrow on the north end of the Content, and throws the outcrop on that side west to the Sunset.

The Nancy Lee Reef trends away from the Golden Gate Reef in a south-easterly direction (*see* Plan 1), and has a north-easterly dip at an angle varying from 1 in 2 to 1 in 1½.

Where developments have taken place in the deep ground beyond the line of junction of the two reefs, some difficulty has been experienced, where two reefs have been found, in deciding which is the Golden Gate Reef and which the Nancy Lee. It has been supposed that the Nancy Lee Reef in being steeper than the Golden Gate Reef has crossed the latter, and that a reef found in Plant's shaft in the deep ground at a depth of 804 feet is the Golden Gate Reef, while the lower reef at

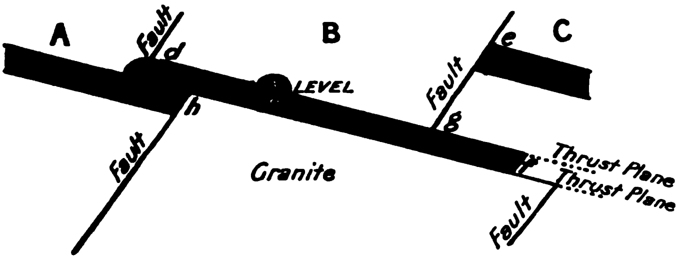
ections of Portion of Workings on Nº 5 S. & Nº 4 & 5 S. Block

Showing overlaps of Reef, faults & Dykes

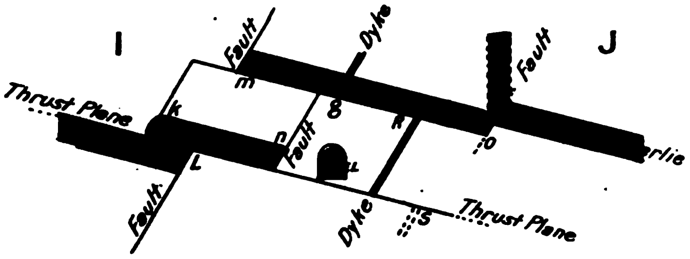
Scale 25 feet to an Inch

25 20 15 10 5 0 25

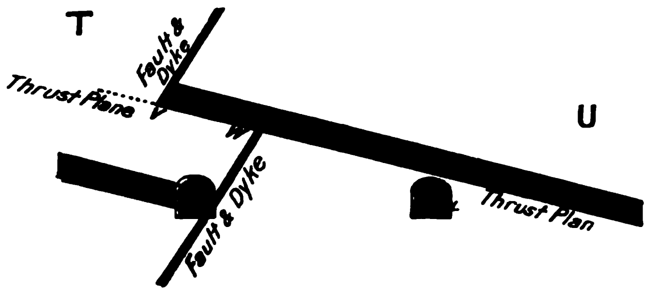
Section on Line A.B.C (Plate 3)



Section on Line I.J (Plate 3)



Section on Line T.U (Plate 3)



(Illustrating Report on "Some Croydon Gold Mines")

925 feet must be the Nancy Lee Reef. On the other hand the Nancy Lee Reef has not been observed to pass through the Golden Gate Reef where it has been exposed in ground nearer the outcrop.

Sections of the two reefs are shown in several of the accompanying plans. Plan 13 shows a diagrammatic section of the country through the Nancy Lee Consols shaft, from the outcrop of the Golden Gate Reef to Plant's shaft, and indicates the possible relation of the two reefs to one another. Other sections of the two reefs are shown on Plans 12 and 14, and on Plate 6, Fig. 1, and on Plate 12. Further reference to this portion of the subject will be referred to on page 30, in describing the operations at Plant's shaft.

MINES AT THE NORTH END OF THE GOLDEN GATE LINE OF REEF.

At the northern end of the line of reef, at varying distances from Golden Gate Creek (*see* Plan 1), a number of prospecting shafts have been sunk for the purpose of finding a continuation of the reef which to the south has proved so productive. Many of the shafts have been successful in discovering a reef or formation, but without finding payable gold-bearing stone further north than the mine known as No. 10-and-11 West.

A very large "formation" having well-defined walls is present at this end of the field, and is associated with a barren quartz reef and with leaders.

It will be seen on reference to Plan 1 that the felsite in contact with the granite takes a sharp turn on this part of the field, and is close to the line of outcrop of the reef. Possibly the mass of felsite has here produced compression in the granite, and, to a great extent, has prevented the formation of a fissure, and that in consequence the reef has much diminished in size or pinched out altogether. The positions of the shafts are shown on Plan 1, and also on Plan 2, on a scale of 100 feet to one inch.

No. 10 NORTH, No. 10-AND-11 WEST, AND No. 9 NORTH.

No. 10 North, No. 10-and-11 West, and No. 9 North are the mines at the northern end of the field where the reef has been proved to be gold-bearing. Mining operations here have been conducted on a large scale, and the accompanying Plans (2, 3, and 4), show the underground workings on a scale of 100 feet to one inch.

A specially interesting feature in this part of the Golden Gate reef is the marked change in the direction of dip from the normal north-north-east to one more nearly north, and the rich yields of gold from the reef where this irregularity in the reef takes place. Another feature is the convergence of a number of curved lines and faults met with in the eastern workings of No. 10 North, an effect evidently resulting from the unequal pressure exerted by the mass of felsite previously referred to, and which must be close to the end of the underlie sunk from the 111-ft. vertical shaft in the ground of the No. 10 North.

On Plan 2 is shown the position of the granite and felsite in relation to these mines, and also the reef in the mines known as No. 8 North, No. 9 North, and No. 10 North. The effect produced by the irregularity in the line of contact of the granite and felsite is, in part, to compress the granite opposite two folds of felsite, and to prevent the formation there of fissures. This would result in the formation of reefs of diminutive size, and would account for the small thin vein in the mines referred to above, where the workings have advanced close to these felsite protuberances; while the country between the folds would be sufficiently released from pressure to allow of large fissures being opened, and which subsequently would be filled with quartz. In No. 10 North (*see* Plan 2, Sheet 1) the reef becomes well-defined as the distance from the felsite increases, and in No. 9 North the country would be favourable for the formation of a thick reef where the depression exits between the folds—that is, about north of the 145-ft. vertical shaft, and near the bed of the Golden Gate Creek.

In No. 10 North the granite to the south-west of the felsite fold must be very much compressed, and the probability of finding there anything but small veins of quartz is very remote. The workings further east on No. 10 North (*see* Plan 3) indicate that a large amount of exploratory work has been undertaken for the purpose of finding a continuation of the rich stone met with nearer the outcrop. The severe roll, or fall-over, on which the winze (marked L on Plan 3) has been sunk, trends easterly and gradually dies out, a joint or fault having a south-easterly strike only now being visible. It would not be possible to follow this fault line with any certainty of picking up the reef again, as its junction with other faults in the vicinity would undoubtedly cause confusion, the best course being to drive northerly, as mentioned above, from the present workings in No. 9 North.

The country east of the granite-felsite boundary does not offer any encouragement for prospecting, and the only hope of finding a gold-bearing reef there is to sink through the felsite into the granite which underlies it, and pick up the Golden Gate reef in the deep ground.

No 8 NORTH GOLDEN GATE (LEASE 637) CROYDON CONSOLS.

There are very extensive underground workings in this lease, and a very large yield of gold has been obtained from the reef in the western portion of the ground. The felsitic rocks occurring in the lower (eastern) workings are not of the pronounced type as those further north-west, and are more basic in composition. Where they are in contact with the granite a disturbance has taken place, and in this disturbed zone the mining developments which have been carried on have not been successful in obtaining gold-bearing stone sufficiently rich to pay working expenses. It must be noted, however, that the felsite here differs very much in its mineralogical characters from the felsite which has been met with in the Golden Gate Consols adjoining lease, where the reef has proved very productive in the deep ground. After an examination of the underground workings, no special feature could be pointed out to encourage further development, either by sinking the 365-ft. (No. 3) Block shaft to a greater depth or by extending the underlie from it.

On Plan 2 the position of the underground workings on the mines of the Croydon Consols are shown, and on Plan 5 a vertical section illustrates the workings from west to east, on a scale of 100 feet to an inch.

No. 7 NORTH, No. 5-AND-6 NORTH, AND DOUGLAS BLOCK SHAFT.

Most of the gold-bearing stone in No. 7 North was worked out many years ago, and very little of the reef now remains which has not been prospected either by underlie or by levels. In the lower levels the reef is of very small size, and where prospecting operations have been discontinued in the deeper workings near the eastern boundary, the reef is only a couple of inches thick, which, however, is gold-bearing. From observations made in the adjoining mine to the north (No. 8 North) it would appear that the reef exposed in the bottom workings of this mine is not the only one in existence; but, as the others must be very small and the country they occur in very hard, it would be impracticable to prospect further. It also is apparent that the reef worked in the north-east corner of No. 7 North corresponds to the footwall and not the hanging-wall leaders met with in the underlie workings of No. 8 North.

The thinning-out of the reef on the eastern boundary of No. 7 North probably extends easterly and south-easterly into the Golden Gate Consols ground (Lease 687), and to the country which would be worked to the dip from the Douglas Block shaft.

To the south-west of the Douglas Block shaft, and between the workings of the No. 5-and-6 North, and those of the Golden Gate Consols northern underlie, there is a large area of unprospected country. Tracey's underlie has passed through a large belt of barren reef, and the prospecting work in the Douglas Block shaft has failed to find gold-bearing stone. The reef, therefore, between Tracey's underlie and this Block shaft does not present any sufficiently favourable feature to warrant any further development on it in this direction.

In the underlie from the 87-ft. vertical shaft, near the centre of the No. 5-and-6 North, payable stone has been met with, and possibly a continuation of this shaft in depth might reveals the occurrence of stone in the north-western portion of the large area between the workings of the No. 5-and-6 North, the Golden Gate Consols northern underlie and the Douglas Block shaft.

In making a plan of the underground workings in the No. 7 North, it was noticed that several faults or breaks trend in a northerly direction, and, on further examination, their continuation was traced into the workings of the No. 5-and-6 North. They form a number of parallel lines in plan, but in section their angles of inclination are not uniform. Their direction is persistently northerly, but as they trend from the workings in this direction, very probably they will be found to bend around to the north-west to conform with the general strike of the reef and the disturbances in No. 8 North.

On Plan 2 is shown the portion of the underground workings in the No. 7 North, No. 5-and-6 North, and Douglas Block shaft; and Plan 6 shows the same workings in vertical section.

GOLDEN GATE CONSOLS.

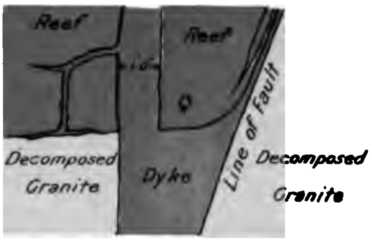
The workings on this mine consist of an underlie shaft, which has been sunk almost from the outcrop of the reef to the deep ground on the eastern boundary, and a second underlie from the bottom of the 226-ft. vertical shaft which continues along the course of the reef into the deep ground close to the eastern boundary. The two underlies are connected by levels, and the work of developing the rich ore reserves around the bottom of the second (southern) underlie is now being carried out.

The country in which the reef exists in the deep ground is not uniformly the coarse-grained mica granite found nearer the outcrop further west, but is made up of this rock with coarse and fine-grained binary granite having included masses of felsite.

The character of the rocks in the bottom levels suggests that the country to be met with on the other side of the boundary, in Lease 876, will be similar to that found in the deep levels of No. 7 North (Croydon Consols), where binary granite and felsite merges into a quartz-felsite. The latter rock has not been found in the Golden Gate Consols Mine, but the positions at which this rock has been observed may be seen on referring to Plan 2, on which also is shown the approximate surface line of contact between the granitic and felsitic country. The junction of the granite with quartz-felsite and binary granite along this line of contact, it will also be observed, extends further north-west into No. 8 North, and the angle of inclination in this mine

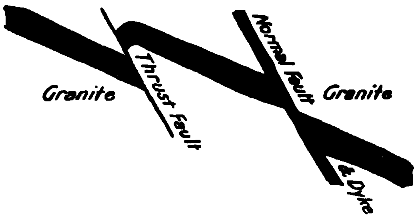
Sections in No. 5 South Viles' Block
& No. 8 South Block

Fig. 1



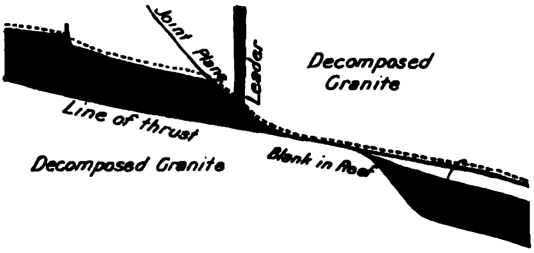
Dyke intrusion in 17 N. Level. No. 5 South
Showing the Dyke intrusion in the Reef and along the Fault

Fig. 2



Section in Viles' Block Underlie Shaft
Showing dislocations in the Reef

Fig. 3

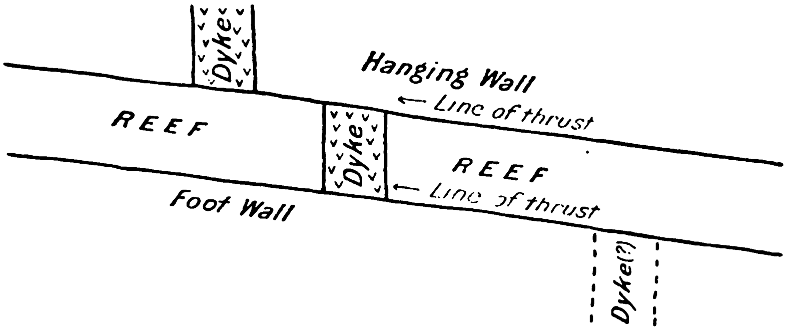


Section in Winze above No. 1 South Level in No. 5 South Mine

(Illustrating Report on "Some Croydon Gold Mines")

(*see* Plan 5) if continued in the ground of the Golden Gate Consols, would indicate the granite to probably underlie the felsite at an angle of over 40° from the horizontal.

Fig. 2.



SECTION ON NO. 2 NORTH LEVEL, GOLDEN GATE UNITED MINE.
(*Showing the disturbance of a Dyke by Faults along the hanging and foot walls.*)

At the depth of the workings in the Golden Gate Consols, the felsite (with the above angle of inclination from the surface) would be a considerable distance away from the eastern boundary of Lease 687, so that no anxiety need be felt that the unfavourable condition met with in that mine will be repeated here. At the same time, in the No. 8 North the change from favourable to unfavourable conditions is remarkably sudden, and it would be advisable to study the deep workings in this mine with a view of applying the information obtained to the developments proceeding in similarly deep ground in the Golden Gate Consols.

A section of the underground workings of the Golden Gate Consols is given in vertical sections on Plan 7, which also shows the approximate position of the line of contact between the granitic and felsitic rocks. An examination of this section and that of the underlie workings in the No. 8 North, together with the plan of the same workings (*see* Plan 2), indicates the probability of the reef splitting up into a number of small veins, and that in consequence, in prospecting one of them, others might be passed over or neglected, which possibly would be equally, if not more, important from a gold-bearing point of view.

It might also be added that the occurrence of leaders in various parts of the deep workings here is only a repetition of what has been experienced in the Croydon Consols Mine, and attention to the peculiarities noticed in that mine, as stated before, might be of great advantage in elucidating local features as they became exposed.

GOLDEN GATE LIMITED (ROGERS' No. 1).

The western workings in the Golden Gate, Limited, begin at a shallow shaft (No. 1 shaft) close to the outcrop near the western edge of the lease. This portion of the ground was worked many years ago, and, as most of the underground workings could not be examined during the recent inspection, an old survey plan in existence has been utilised to show their position.

To the west of No. 2 shaft (*see* Plan 2, Sheet 2), the mining developments have disclosed a disturbance in the reef, and this proves to be a fault in combination with an overlap. A section of this is shown on Plan 8, while an enlarged section is represented in Fig. 1, page 13. The overlap probably extends further north, along the strike of the reef, but nothing has been seen of it in the workings of the Golden Gate Consols, and it probably pinches out in the country between the two mines. In a southerly direction the disturbance is evidently persistent in its occurrence, a dyke and fault having been passed through in No. 6 shaft, and quite probably the overlap referred to above also exists here.

From the No. 2 vertical shaft an underlie has been sunk in an easterly direction, and from this a prospecting level has been driven to the north, in which mineral has been found in both the reef and the altered granite walls, but the presence of gold has not been detected.

From No. 3 (Block) shaft three underlies have been sunk. In the old (eastern) underlie the stone was too poor for working, but the dip of the reef, instead of being east-north-east, was found to bear more to the north, and necessitated the sinking of another underlie from the same shaft before further exploratory work could be undertaken. Later on, new features developed, and the third underlie was sunk, the second one in its turn being abandoned. It will be seen on Plan 2, Sheet 2, that the stone to the east and also to the east-north-east and east-south-east has not been touched, while that north from No. 2 has been completely worked out. The payable stone here is entirely on the western side of the present working underlie, and the shoot of stone passes into the Golden Gate Consols Mine adjoining, where it now is being worked.

The Extended Block shaft (No. 4) has been put down to develop the Gate Reef in Lease 732, but up to the present has not succeeded in finding stone sufficiently rich to pay for the necessarily heavy working expenses. Evidently the shaft is in a poor zone, whose outcrop is principally in the ground of the No. 1-and-2 Golden Gate, and whose boundary touches the workings of the Golden Gate, Limited, to the north-west, and the workings of the Golden Gate United to the south-east. In this generally poor zone, however, the indications show that gold-bearing stone occurs in small, rich patches, but very irregular in ocurrence.

The change from granitic to felsitic rocks, easterly from the Extended shaft, takes place some distance away on the surface, and as the line of junction between these two series of rocks has an easterly dip, the granite must extend to a distance greater than 1,000 feet easterly from the bottom of the Extended Block shaft. If a shoot

PLATE 6

Diagrams & Sections

Illustrating features in the G.Gate & Nancy Lee Reefs

Fig. 1

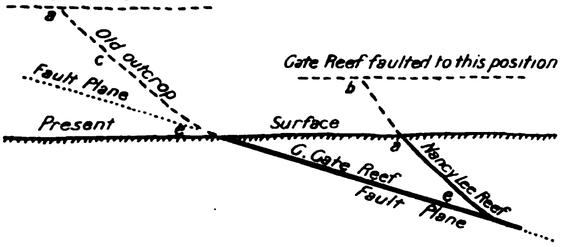
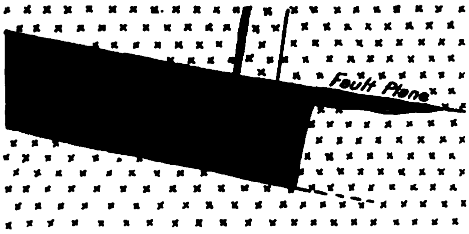


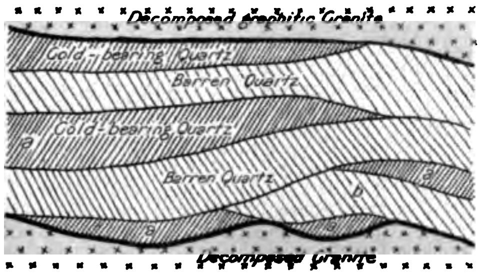
Diagram illustrating the possibility of the Nancy Lee Reef being a portion of the Gate Reef faulted from a higher level

Fig. 2



Section in P.C.Underlie, Nancy Lee Reef
showing the effect of faulting

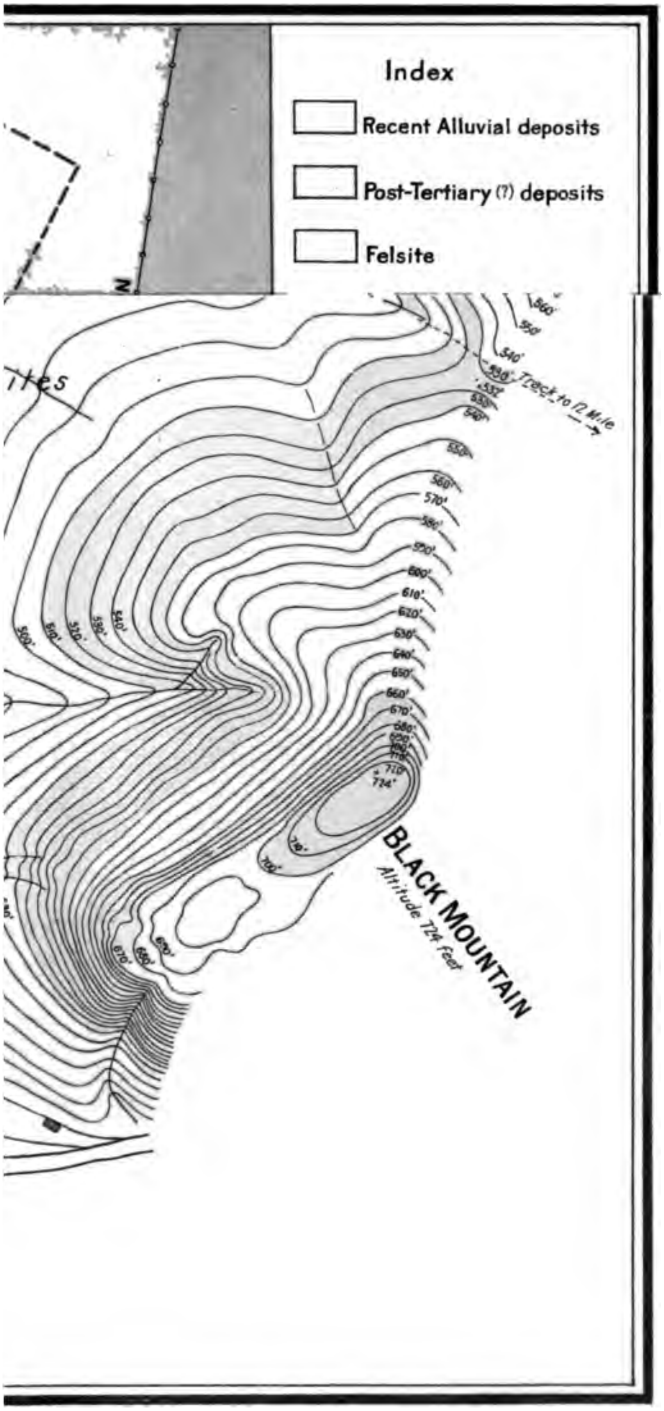
Fig. 3



Section of Gate Reef at Nº 8 South Block Mine showing the alternations of Gold-bearing and barren Quartz

(Illustrating Report on "Some Croydon Gold Mines")

PLAN I



Printed at the Govt. Printing Office. Brisbane 1905

GOLDEN GATE UNITED.

On this mine the 173-ft. vertical shaft has been sunk in a fault extending from the No. 3-and-4 and the No. 5 Leases further south, and which evidently continues northward towards Rogers' No. 1. The underlie from the vertical shaft has been sunk for a considerable distance, and about one-third of it has passed through payable gold-bearing stone. In the first 200 feet the reef has proved to be barren, and for about the same distance at the bottom of the workings the same class of stone has been met with. About the central portion of the underlie an area of good stone has been worked out.

Dykes and faults have proved troublesome, and an overlapping of the reef exposed in No. 3 South level was the cause of much dead work being undertaken before this feature in the reef was understood. The portions of the reef which have been proved to be gold-bearing are of limited extent, and are shown on the general plan of the workings (Plan 2, Sheets 2 and 3), while on Plan 10 some peculiarities which have been observed on the structure of the reefs are illustrated in vertical section.

The gold-bearing stone in the reef is a continuation of the same shoot worked in the No. 3-and-4 Lease adjoining the United (to the south), but from its failure to discover good stone the level near the bottom of the underlie is evidently in poor country. The prospect of finding rich shoots of stone seems to depend more on the extension of the workings in the deep ground than upon the continuation of this bottom level.

Fig. 2, page 21, Fig. 3, page 23, and Fig. 4, page 27, show sections illustrating features in the Golden Gate United.

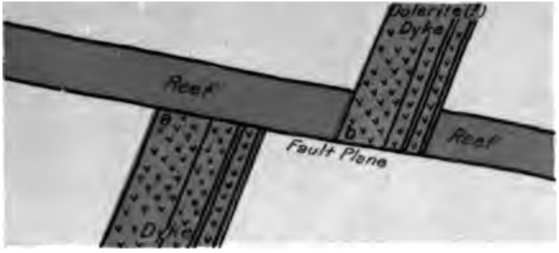
No. 3-AND-4 SOUTH.

This mine in past years produced a large quantity of gold, but the reef is nearly exhausted, and only the lower portions of the north-east corner remain untouched. The faulting and overlapping of the reef in the Golden Gate United Mine extends southerly through the No. 3-and-4, and have given rise to much trouble in exploratory work. The position of the workings in this lease is given on Plan 2, Sheet 3, and vertical sections are illustrated on Plan 10. The sections on the latter plan show the disturbances in the reef near the No. 3 (95-ft.) shaft, and at the bottom of the underlie shaft. The country above the reef has been thrust towards the west, producing a horizontal overlap in the reef in the deep ground, and at the same time forming a corresponding gap or blank in the reef further west at the bottom of the No. 3 shaft. This overlapping and the blank area is shown in Plan 2, Sheet 2, these features, it will be observed, extending both in a northerly and southerly direction.

Diagramatic Sections

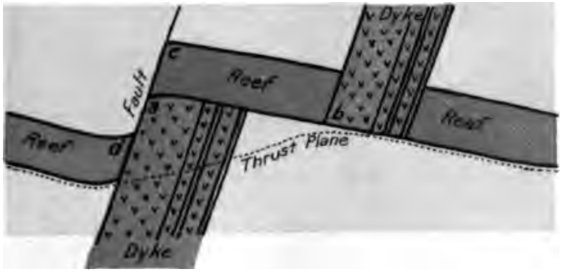
Ilustrating the succession of faults in the Gate Reef in No 9 South Underlie

Fig. 1



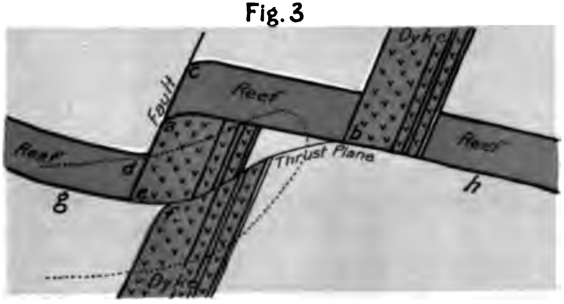
Dip Fault dislocating a Dyke along the footwall of Reef

Fig. 2



Normal faulting of the Reef along the hangingwall of the Dyke .

Fig. 3



Thrust Fault disturbing the lower portion of the Dyke

(The part enclosed within the dotted lines is exposed in the bottom of underlie)

(Illustrating Report on "Some Croydon Gold Mines")

No. 5 SOUTH, No. 4-AND-5 SOUTH BLOCK ("98"), MORGAN'S BLOCK SHAFT, AND THE GOLDEN GATE AND NANCY LEE UNITED (VILES').

The blank area near the surface, referred to previously, has been traced in a southerly direction from the No. 3-and-4 South across to the No. 5 South. A section of this break or fault is shown on Plate 5, Fig. 3, which, in addition, illustrates the normal faulting and the subsequent thrust faulting of the reef. From the blank area to the western side of the No. 5 Lease the reef has yielded rich stone, and the continuation of this shoot has also been worked in the adjoining No. 4-and-5 South Block.

The overlap in the No. 3-and-4 South Mine crosses the boundary of the No. 5, passes through the No. 4-and-5 South Block into the underlie of the Golden Gate and Nancy Lee United (Viles'). In the latter mine the fault has a drop of about eighteen feet, a section of which is shown in Plate 3, Fig. 3.

The movement in the hanging-wall country forming the blank area near the surface, and the overlap lower down the dip of the reef, has produced a second blank area in the reef further down the dip. A section of this is shown on Plan 11.

A plan and section of the workings in the No. 4-and-5 South ("98") are represented on a large scale on Plates 3 and 4, and on Plate 1 is illustrated a dyke intrustion which, by subsequent disturbance, has produced a rather complicated effect close to the bottom of the vertical shaft in this mine. The diagrammatic sections given on this plate show the successive movements in the faulting of the reef to be (1) the dyke intrusion, (2) the normal faulting of the dyke and reef, and (3) the faulting of the hanging-wall country along the thrust planes parallel with the reef. The position of the dyke (*see* Plate 1, Fig. 1) at *r* is above that at *y*, but the effect of faulting throws the portion *x* below that at *y*.

Some features are illustrated on Plate 2 bearing on the blank area in the No. 4-and-5 South Block. In Fig. 1 the reef is thrown a few feet along a previously existing joint plane, and the thrust movement along the *hanging-wall* of the reef at the lower level has been transferred to the *footwall* of the reef at the higher level. Fig. 2 shows a modification of the same effect: the fault has dropped the reef, and the thrust plane has been transferred from the hanging-wall to the footwall, the reef making a roll before faulting. Prior to the faulting, this monoclinal fold or roll has been produced in the reef at *g* and *h*. By the subsequent thrust the folded portions have been sheared, and while the portion *g* remains close to the fault, the portion *h*, being on the lower side of the thrust plane, has been detached from *g*, and transferred to *f* with the lower part of the reef.

Fig. 3 illustrates a further modification. The line of thrust has been confined to the hanging-wall, and the upper part of the fault has been driven along the top of the reef to the portion *b*. In this case the reef is not separated horizontally, and no blank belt or area has been formed.

On Plate 5, Fig. 3, a section is given of the winze between the 20-ft. vertical shaft and No. 1 south level, in the No. 5 South Mine, illustrating the dislocation of the reef to form a blank belt between the hanging-wall and footwall. The section also indicates the position of the vertical leader joining the Golden Gate Reef in this part of the mine, and which is not connected with the Nancy Lee Reef in the vicinity.

Plan 10 shows the position of the workings at Morgan's Block shaft with regard to the underlie workings in the Golden Gate United, and also indicates, so far as the inclination of the reef is concerned, the relation of the workings of the No. 3-and-4 South, and those of the No. 4-and-5 South Block (" 98 ") to be the same.

The deep ground in Morgan's Block and in the west portion of the " 98 " has not been prospected, but the richness of the reef along the frontage of the greater portion of this ground offers a very strong inducement for further prospecting operations. Even with the presence of a belt of country carrying poor stone, which is apparent between Morgan's Block and the shoot of rich stone in the Golden Gate United and the No. 3-and-4 South, it is reasonable to suppose that shoots similar in behaviour and character will exist at deeper levels.

Fig. 1, Plate 5, shows the relation of the dyke rock to the reef, the section indicating that the intrusion of dyke rock has taken place subsequent to the formation of the reef, and consequently would appear to have had no influence on the deposition of the gold.

The position of the workings in the Golden Gate and Nancy Lee United are shown on Plan 2, Sheet 3, and two vertical sections are given showing the underground features on Plan 11.

NANCY LEE REEF.

Close to the outcrop of the Golden Gate Reef, near the boundary of the No. 3-and-4 South, some confusion has been caused by the presence of a number of outcrops which evidently belong to reefs branching off from the main one. The surface workings of the No. 3-and-4 South have exposed a reef or " formation " associated with the Golden Gate Reef, but which, evidently, belongs to the Nancy Lee. Plan 2 (Sheets 2 and 3), shows the outcrop of the two reefs, together with their line of junction, and Plans 10 and 11 respectively illustrate vertical sections taken across No. 3-and-4 South and No. 5 South.

From the No. 5 South the outcrop of the Nancy Lee Reef evidently trends south-easterly, while the Golden Gate Reef trends further towards the south, and, consequently, the distance increases between

PLAN 4

ONS OF UNDERGROUND WORKINGS
IN
orth (Lease 1017) and Nº 10 & 11 West (Claim)
Golden Gate Line of Reef

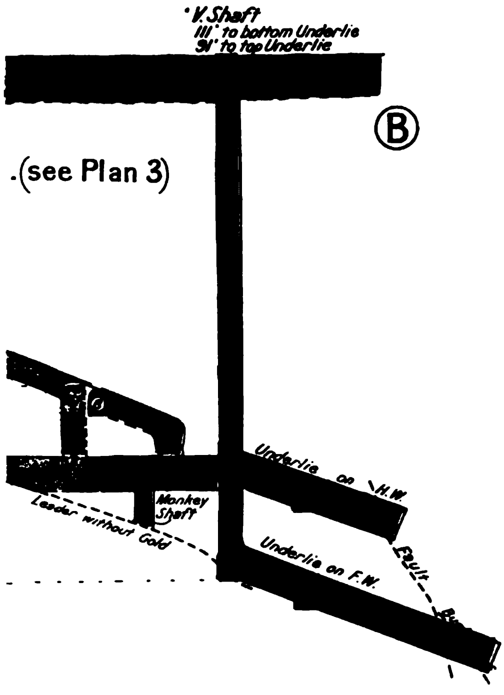
B. DUNSTAN F.G.S. ACTING GOVT GEOLOGIST

llustrating Report on the Croydon Gold Mines

1904

Scale 40 feet to an Inch

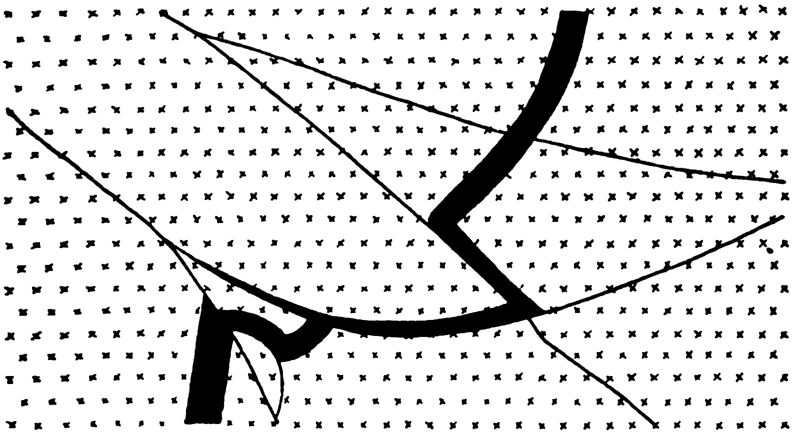
Drawn by H W Fox at the Geological Survey Office Brisbane



the two outcrops, as the depth at which their junction takes place becomes greater. These features are illustrated on Plan 2, Sheet 3.

From No. 5 South the Nancy Lee continues into the No. 8 South (Baltic), where it has been worked in the Rose of Denmark shaft. This shaft was sunk many years ago, and the workings are inaccessible at the present time; but some of the miners who have worked in it state that four or five nearly vertical leaders exist close to the north side of the shaft, which have an approximately east and west strike, and are all gold-bearing. Evidently the leaders are not persistent in their occurrence, as a shallow hole to the west of the shaft failed to trace any indication of them. One of the leaders in the shaft passed out at the north side about thirty feet below the surface, but was found again in the underlie thirty feet from the vertical shaft.

Fig. 4.



SECTIONS 20 FEET BELOW NO. 2 NORTH LEVEL, GOLDEN GATE UNITED MINE.

(*Showing the irregular intrusion of the granite by a (?) dolerite dyke.*)

It is stated that at the bottom of the Rose of Denmark shaft the reef was followed down the underlie, and at the bottom it suddenly pinched out, and that in the north level a "formation" exists without a reef being present. Probably the pinching out at the bottom of the underlie is due to the fault which traverses the country to the east of the underlie, and if this be so, the reef which has been lost will be found in the hanging-wall country on the eastern side of the disturbance. In Viles' (Golden Gate and Nancy Lee United) underlie, the fault indicated a throw of about twenty feet, and this distance may be taken as a general guide for sinking were it thought advisable to prospect for the reef in the Rose of Denmark shaft.

South from the Rose of Denmark shaft, the Nancy Lee Reef has been worked in the leases now known as the No. 8 South Block, No.

9 South Block, and No. 10-and-11 South Block. In the No. 8 South Block the outcrop is close to the working shaft sunk on the Golden Gate Reef, and several shafts have exploited the Nancy Lee Reef. These mines could not be inspected, and the position of the underground workings, shown on Plan 2, Sheet 2, are only approximate. Plan 12 shows a section of the Rose of Denmark shaft, and also the relative positions of the Golden Gate and Nancy Lee Reefs.

In the No. 9 South Block the Nancy Lee Reef has been worked very extensively, and many thousands of tons of stone have been treated with very satisfactory results, but the workings have been abandoned for many years past. In No. 10-and-11 South Block the reef has been prospected by the P.C. underlie shaft and by two long levels from the underlie, a large area of ground being stoped out. Two cross leaders have been met with and are shown, with other features, on Plan 2, Sheet 3.

Further south, the outcrop of the Nancy Lee Reef has been traced to the cross reef known as the "Iron Duke," which apparently has faulted it. At Drawbridge's "Engine" shaft (in the Golden Gate and Nancy Lee Consols) the Nancy Lee Reef is stated to have been met with about seventeen feet below the surface, and is supposed to extend to Drawbridge's Nancy Lee shaft, where it occurs at 199 feet below the surface.

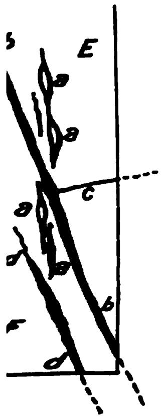
In the Nancy Lee Consols shaft, on No. 9 South Block, the Nancy Lee Reef was passed through at a depth of 300 feet below the surface, the Golden Gate Reef being penetrated at 100 feet lower down.

The whole of the workings of the Nancy Lee Reef is shown on Plans 2 (Sheets 2 and 3), 12, and 13, while other features are represented on Plate 6 and Plan 14. Fig. 2, Plate 6, represents a section in the P.C. underlie in which the effect of the faulting on the Nancy Lee Reef is shown. The footwall fault has, at an angle with the plane of section, broken through a roll in the granite below the reef, and has thrust the reef against the undisturbed portion of the roll in the footwall. The section on Plan 14 diagrammatically represents the Nancy Lee Reef to be faulted east of the "Engine" shaft, an effect necessitating the same reef outcropping again between this shaft and the Nancy Lee shaft. The section of the reef in the "Engine" shaft indicates the presence of a fault, but the surface features (*see* Plan 2, Sheet 3) indicate an uncertainty in this respect. Developments in future may reveal further information; but, in the meantime, no definite idea can be formed as to its behaviour.

Towards the south of Drawbridge's (Golden Gate and Nancy Lee Consols), the Nancy Lee Reef apparently outcrops to the west of Walsh's Block shaft (*see* Plan 2, Sheet 3), and is met with as a "formation" in the latter shaft at a depth of 78 feet from the surface (*see* Plan 14). To the south of Walsh's Block shaft the Nancy Lee Reef has not been traced.

Fig. 1

"Butcher Boy" Leader in Plants (G.G.G. Mines) Shaft



a. Veins of Fluorspar and Calcite

b. "Butcher Boy" (?) Leader, dips North Westerly, nearly vertical

c. Flat Leader, dips East 1 in 3

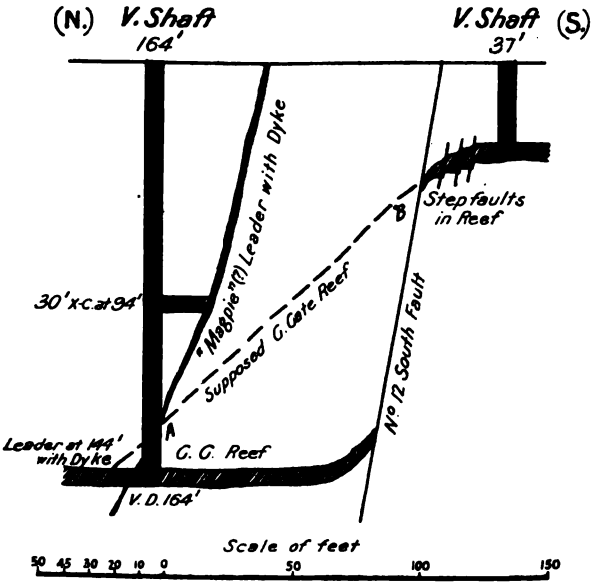
d. Small Leader parallel with "Butcher Boy"

E. Hard Syenitic Granite above "Butcher Boy"

F. Soft partly-decomposed Sy. Granite below "Butcher Boy"

Fig. 2

Section across Fault ("Break") at No. 12 South



(Illustrating Report on "Some Croydon Gold Mines")

No. 7 SOUTH, No. 8 SOUTH (BALTIC), No. 8 SOUTH BLOCK, No. 9 SOUTH, No. 9 SOUTH BLOCK, No. 10 SOUTH, No. 11 SOUTH, AND No. 10-AND-11 SOUTH BLOCK.

On the lease known as No. 7 South Golden Gate, the surface workings show that a small fault has taken place at right angles with the Golden Gate Reef, and that in consequence the reef on the south side has been thrown back for some distance. The developments in this shaft (Threzeder's) will probably reveal the character of the fault and of the leaders traversing the Golden Gate Reef in an east and west direction.

In the No. 8 South Golden Gate (Baltic) the underlie shaft penetrated disturbed country, and was not further continued. In the adjoining mine (No. 9 Golden Gate) a continuation of this disturbance was met with at the bottom of the underlie close to the eastern boundary, where it is associated with an intrusive dyke. The depth at which the reef occurs in the latter mine, and in the No. 8 South Block to the east, shows that the disturbance has resulted in the reef being faulted along a line bearing north and south, with a downthrow on the west side. On the No. 8 South Block the workings show that the dyke has caused very little disturbance of the reef, but in the No. 9 South underlie there are a series of faults, along one of which the intrusion of a (?) dolerite dyke has taken place.

The section on Plan 12 shows the general inclination of the Golden Gate Reef, and also the faults in the No. 9 South, while diagrammatic sections illustrating the succession of faults in the bottom of the underlie in the same mine are given on Plate 7. Fig. 1 shows the Golden Gate Reef broken through by a dyke, with the top portion of the reef faulted from *a* to *b* on the footwall. The same reef is shown in another stage in Fig. 2, the portion to the left in that figure being faulted down on the hanging-wall of the dyke from *c* to *d*. Fig 3 illustrates the final movement, in which the reef and the fault and dyke have been driven from right to left along the thrust plane *g-h*, and dislocating the dyke at *e-f*.

In the No. 9 South Block the Golden Gate Reef falls over at an angle of 45° in the No. 4 level. The underlie to this followed the dip of the reef, but further down it has been continued in "formation." It was noticed, when the plans of the Golden Gate and Nancy Lee Reefs were being plotted, that the disturbance in the Golden Gate Reef marks the eastern limit of the gold-bearing stone, and that immediately above there is a similar disturbance in the Nancy Lee Reef which marks the boundary of the western limit of the gold-bearing stone. These features are illustrated in the vertical section on Plan 12, and their relative positions are shown on Plan 2, Sheet 3. Other references to the Nancy Lee Reef are given on page 26.

In the No. 10 South shaft a continuation of the fault observed in the No. 9 South Mine has not been seen, but probably it will be found to occur further west towards the outcrop, where the reef may be expected to have a downthrow on the western side. The underlie in the No. 11 South lease has passed into a large body of quartz and "formation" having a thickness of about thirty feet, the walls of which are at present unknown.

The workings connected with the No. 10-and-11 South Block shaft have not resulted in the discovery of rich stone, and this may be said also of the deep shaft in the Nancy Lee Consols. The latter shaft is sunk to a depth of 420 feet, the Nancy Lee Reef and the Golden Gate Reef being passed through at 300 and 400 feet respectively. Plans 2 (Sheet 3), 12, and 13 show the underground workings of No. 7 South, No. 8 South, No. 9 South, No. 10 South, No. 11 South, No. 8 South Block, No. 9 South Block, and No. 10-and-11 South Block, together with a diagrammatic section across the Golden Gate Reef from the outcrop on the west side of the field to the deep ground at the bottom of Plant's (G.G.G.M.) shaft.

The alternations of poor and rich stone in the No. 8 South Mine is illustrated on Plate 6, Fig. 3. The section is typical of this part of the Golden Gate Reef, and the data accumulated indicate that the deposition of stone has taken place at two distinct periods.

Fig. 1 on the same plate (No. 6) diagrammatically illustrates the possibility of the Nancy Lee Reef being portion of the Golden Gate Reef, particulars of which have previously been referred to.

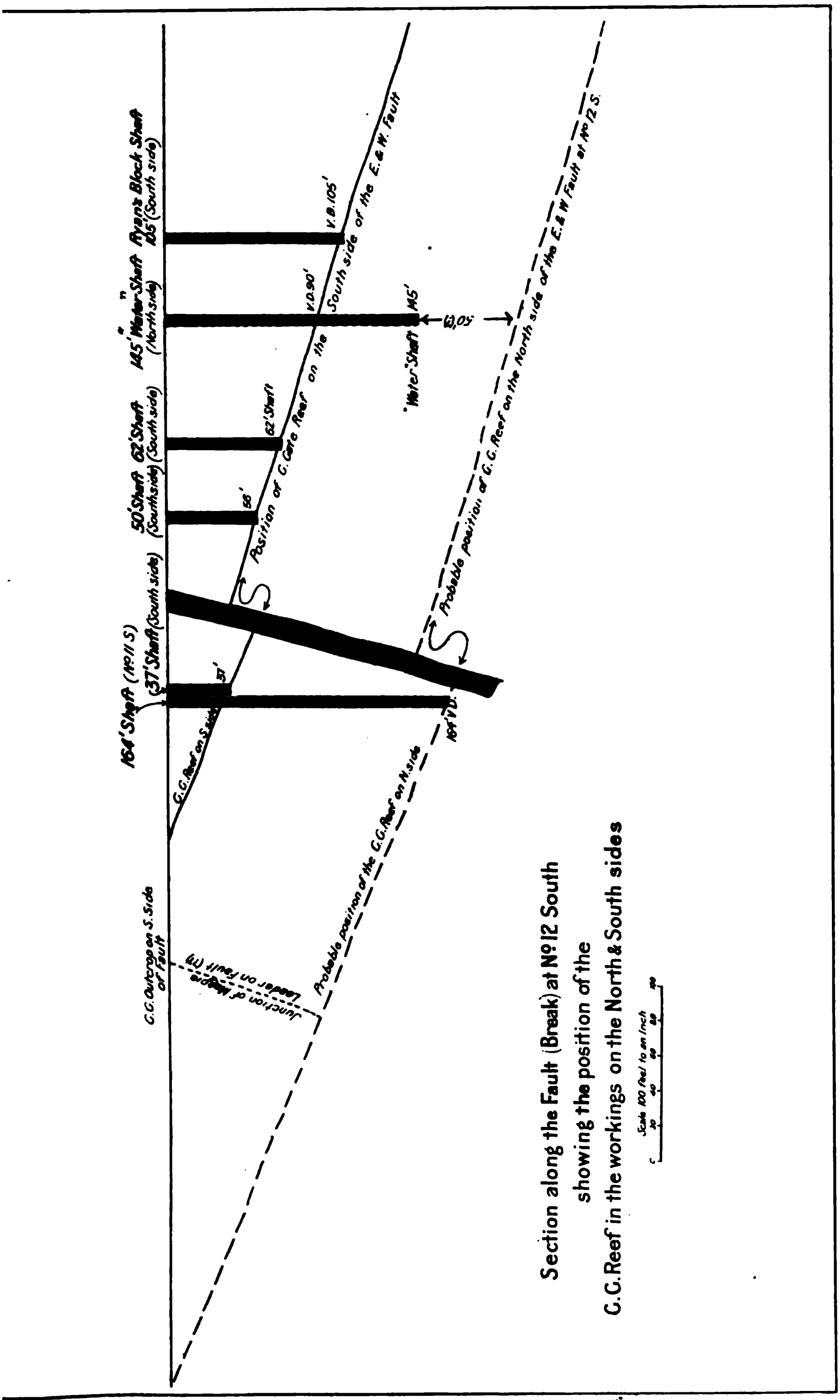
PLANT'S (GOLDEN GATE GOLD MINES) SHAFT.

A section from the Golden Gate Reef outcrop, through the Nancy Lee Consols shaft to Plant's shaft, is represented on Plan 13. The two lines of reef shown in that section, if extended to the east and if persistent in their angle of dip, would meet between the Nancy Lee Consols shaft and Plant's shaft at the position marked *e*. In the latter shaft two defined quartz reefs were passed through, the top one at 804 feet, the other at 925 feet, the distance from one another being nearly the same as that between the Golden Gate and Nancy Lee Reefs in the Nancy Lee Consols shaft.

If the top reef in Plant's shaft at *d* corresponds with the top reef in the Consols shaft at *a*, its inclination must be considerably reduced from what is known of it between the Consols shaft and its outcrop further west. The inclination of the Golden Gate Reef, on the other hand, must have become greater, as the dip from the outcrop to *b* in the Consols shaft is less than from the latter position to *f* in Plant's shaft.

It may be supposed that the regular angle of inclination of the Golden Gate Reef has been maintained in going into the deep ground, that the Nancy Lee Reef, with its normally steep dip, has crossed the

PLATE 10



Section along the Fault (Break) at No 12 South
showing the position of the
C.G. Reef in the workings on the North & South sides

(Illustrating Report on "Some Croydon Gold Mines")

former reef, and that in Plant's shaft it is below the Golden Gate Reef instead of above it. This would entail the crossing of the two reefs at *c*, and also a flattening of the angle of inclination of the Nancy Lee Reef between the two shafts. Were the steep angle of the latter reef continued to the east of the Consols shaft it would junction with the Golden Gate Reef at *e*, and if continued below the Golden Gate Reef, might be found at *f*, provided that, as mentioned previously, the Nancy Lee Reef has been thrust towards the west by sliding on the hanging-wall of the Gate Reef. In this position the continuation of the Nancy Lee Reef at *e* would be found below the Gate Reef at *g*, and from thence would be exposed at *f* in Plant's shaft. Between the two shafts the distance is very great, and nothing definite can be stated, but it will be seen that there are many problems to consider in view of future developments.

A section of Plant's shaft is shown on Plate 8. The upper portion of the section, it will be observed, is in granitic and felsitic rocks, most of the minerals of which are much decomposed. From this position to the bottom of the shaft the rocks are varieties of granite, but very seldom were they found free from alteration. The quartz and felspar are generally fresh, but the ferro-magnesian constituents have been more or less altered.

The first indication of a reef was observed at a depth of 350 feet, where eight inches of quartz, associated with a very thick belt of graphitic (plumbago) granite, was passed through.

At 550 feet, another belt of graphitic granite was met with in which quartzite inclusions were a conspicuous feature. All through the section of the shaft graphite has been found to be of common occurrence. On Plate 8 it is only mentioned in the references to the section where its presence is a prominent feature.

At 804 feet a reef six inches thick was passed through, with a soft "formation" and graphite on the footwall. This has generally been considered to be the continuation of the Golden Gate Reef. At 925 feet a second reef was penetrated. It is fifteen inches in thickness, and is contained within well-defined walls. This reef has been prospected by putting in a crosscut from the shaft below the reef, levels from which have been driven north and south along its course, the positions being shown on Plan 2, Sheet 2. A well-formed reef occurs in both levels, and contains gold, although not in payable quantities.

Another formation with quartz leaders was found at 1,090 feet, which, quite possibly, might be the Nancy Lee Reef. Were this to be the case, a further modification would be necessary of the theoretical considerations mentioned above.

There is no doubt the hope of finding gold in the deep ground has received a check through the work in Plant's shaft failing to discover a payable reef, but the prospects are by no means exhausted. There are immense gaps between the ore shoots which exist close to the surface in the Golden Gate Reef, and it is quite possible for a number of shafts to be sunk without striking a payable shoot of stone in the deep ground, even were there several very rich shoots present.

Unfortunately, Plant's shaft was sunk in a very undesirable position, but this was not understood when operations began. After developments had proceeded for some time, it became a question whether operations should be suspended, or, in view of the large sum of money already spent without result, and because of the irregular behaviour of the rich ore shoots in the shallow ground which it was thought the shaft would intercept, whether the shaft should be continued to a greater depth.

The probability of being successful in obtaining a payable gold-bearing reef would undoubtedly have been greater had the shaft been sunk further north, and this opinion is expressed by nearly all those who are interested in the matter. All the circumstances point to the question being well worth further consideration.

The cross leader in Plant's shaft at the depth of 1,060 feet appears to be a continuation of the "Butcher Boy" and "Magpie" Leaders occurring in the workings of the Nancy Lee Reef in No. 9 South and No. 10-and-11 South Block, and is referred to further on.

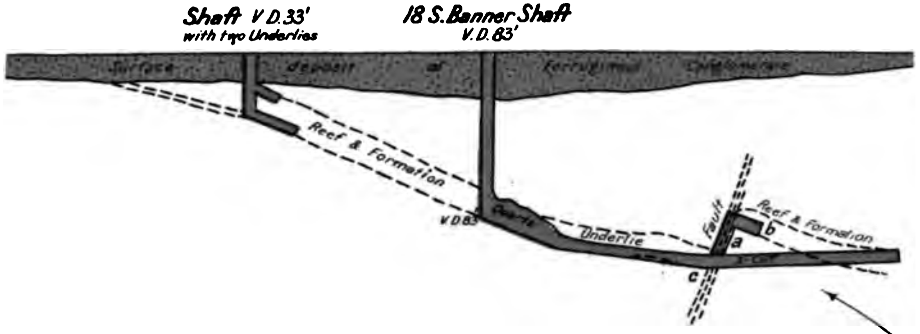
THE MAGPIE AND BUTCHER BOY LEADERS.

The Magpie and Butcher Boy Leaders many years ago constituted rather important features when the Nancy Lee Reef was being developed in the P.C. underlie in the No. 10-and-11 South Block. They are very narrow, seldom more than four or five inches thick, and pinch out in places to a very thin seam. They are, nevertheless, very persistent in their occurrence.

To the south-west of the P.C. underlie the Butcher Boy makes its appearance in the No. 10-and-11 South Block shaft, while further south-west in the No. 11 South, near the outcrop of the Golden Gate Reef, the vertical leader which has been found there is very probably an extension of the Magpie Leader. In the No. 11 South shaft it is found both in the hanging-wall and footwall of the Golden Gate Reef, and is associated with a decomposed dyke rock. It has a north-westerly dip, but is nearly vertical, and probably junctions along its strike with the fault known as the No. 12 South Break.

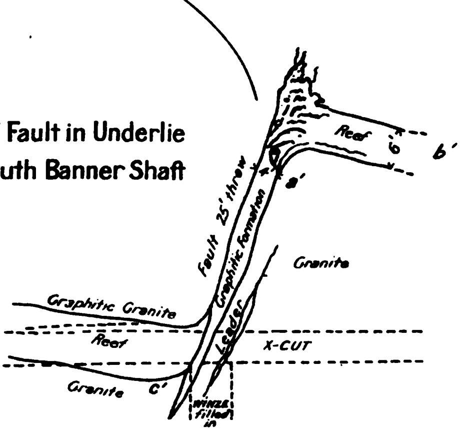
At the north-east extension of these two leaders, stone has been found on the surface between the P.C. Block shaft and Plant's shaft (*see* Plan 2, Sheet 2), and this led to the consideration of the probability of their extending into the latter shaft. If the line of strike of the Magpie Leader be extended to the north-east, the outcrop would pass about 300 feet south of Plant's shaft, and the Butcher Boy Leader, if it persists in being parallel, would be about fifty or sixty feet further north and nearer the shaft. The dip in all observed places shows a north-westerly inclination, and the Butcher Boy would therefore be

PLATE II



SECTIONS OF UNDERGROUND WORKINGS
on 18 South Banner

Scale 100 feet to an inch
0 20 40 60 80 100



Section of Fault in Underlie
18 South Banner Shaft

(Illustrating Report on "Some Croydon Gold Mines")

the one first penetrated in Plant's shaft. The strike and general character of the leader found in this shaft agree with that of the Butcher Boy, but the dip is not so steeply inclined. Fig. 1 on Plate 9 illustrates a section of this and other leaders found in Plant's shaft, and Fig. 2 on the same plate shows, among other features, the position of the Magpie Leader in the 164-feet shaft in the No. 12 South, close to the outcrop of the Golden Gate Reef.

THE IRON DUKE LEADER.

The Iron Duke Leader has been formed on the line of fault which dislocates the Nancy Lee Reef in the No. 10-and-11 South. It has a south-westerly extension, and apparently connects with the No. 12 South fault (or "break") in the water shaft in Ryan's Banner of Freedom. In this latter shaft a steeply inclined leader was passed through, and was supposed to be a continuation of the leader on the No. 12 South fault. This need not be so, however, and from an observation of the surface features (*see* Plan 2, Sheet 3) probably the No. 12 South fault will occur in the "water" shaft lower than the position at which this nearly vertical leader was found.

From previous experience many of the Croydon miners consider that where a reef rolls or falls over, the portion on the north side of the disturbance is very rich, but the probability of finding this particular fault following the rule is very remote. The fault has a downthrow of about 120 feet, so that on the north side the reef would be found about this depth, added to the depth of the reef below the surface on the south side. These features are shown in section on Plate 10. The "water" shaft is 145 feet deep, so it is stated, and would have to be sunk to about 200 feet to reach the Golden Gate Reef, provided, however, the reef was sheared without any steep folding to the north-north-east, which might reduce the distance twenty feet or more. The Golden Gate Reef, therefore, would probably be penetrated by sinking the "water" shaft from forty to sixty feet deeper.

THE NORTH AND SOUTH FAULT AND DYKE ("CLAY HEAD") IN No. 12 SOUTH GOLDEN GATE.

The fault occurring in the No. 12 South has a north-and-south trend, and is remarkable for the severe dislocation which it has produced in the Golden Gate Reef. The dyke found along this dislocation is, in places, between ten and twenty feet in thickness. Its position is shown on Plan 2, Sheet 3, and a cross-section is given on Plate 10.

In the "water" shaft a decomposed dyke occurs associated with the Magpie Leader, and is probably an offshoot from the larger dyke trending northerly to connect with those known in No. 10 South and No. 9 South. On the south end the dyke has been proved to continue for about 500 feet, and probably extends much further in the same direction. From some information obtained regarding th dyke, evidently the down-throw becomes more severe as the distan south from the No. 12 South break becomes greater.

The effect of the north-and-south fault in producing changes level on the Golden Gate Reef is rather confusing, as two outcrops the one reef are produced. Near the No. 12 South fault the reef o the east side of the north-and-south fault rests against the dy some depth below the surface, while further south, with the divergen of the line of strike of the reef and the dyke (*see* Plan 2, Sheet 3), th reef on the east side comes to the surface. On the west side of th dyke, near the No. 12 fault, the reef comes to the surface and forms an outcrop about 100 feet away. (*See* Plate 10.) Southward from this, the outcrop is continued until it is found opposite, and trends parallel with, the outcrop on the eastern side of the dyke, thus producing two outcrops of what once was a continuous reef.

THE BANNER OF FREEDOM (RYAN'S No. 12 SOUTH) AND DRAWBRIDGE'S (GOLDEN GATE AND NANCY LEE CONSOLS).

The workings on this part of the Golden Gate (*see* Plan 2, Sheet 3) have not produced very satisfactory results, partly because of the confusion resulting from the faulting of the reefs and the intrusion of the dykes, and partly because of the poor quality of the stone. There is, however, a large area of country which has not been prospected, and possibly better results may be obtained in future developments.

In Drawbridge's (Golden Gate and Nancy Lee Consols) two shafts have been sunk, one on the Nancy Lee Reef, the other on the Golden Gate Reef, but neither up to the present have produced payable stone.

Drawbridge's Engine shaft was sunk to a depth of 449 feet, and passed through a reef at seventeen feet, and another one at 200 feet. On this part of the field the distance between the Nancy Lee Reef and the Golden Gate Reef should be about 300 feet, and the finding of a reef not more than 200 feet below the Nancy Lee Reef was rather disconcerting. One cause of this can be explained on reference to Plan 14, where it is shown that a fault may bring two reefs close together.

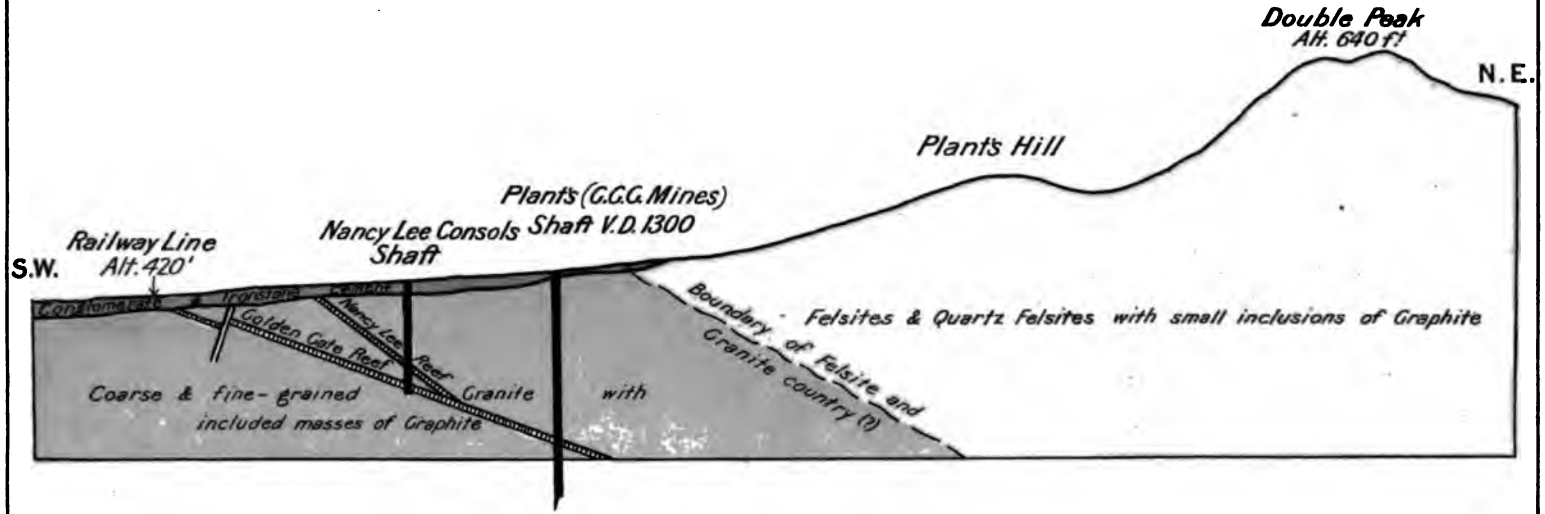
MURRAY'S (No. 14 SOUTH BANNER BLOCK UNITED) AND WALSH'S (GOLDEN GATE AND BANNER BLOCK).

Murray's mine has yielded the largest amount of gold on this part of the Golden Gate line of reef, and recent prospects show that it will continue to be a gold producer in future. With the continuation of the underground developments in this mine, the prospects of Walsh's Block shaft and Drawbridge's Engine shaft are much improved.

Geological Sketch Section

Length of Section about 1¼ miles

Direction from South West to North East


S.W.
Railway Line Alt. 420'
Conglomerate
Ironstone
Nancy Lee Consols Shaft
Plants (G.C.G. Mines) Shaft V.D. 1300
Golden Gate Reef
Nancy Lee Reef
Coarse & fine-grained Granite with included masses of Graphite
Boundary of Felsite and Granite country (?)
Felsites & Quartz Felsites with small inclusions of Graphite
Plants Hill
Double Peak Alt. 640 ft
N.E.

(Illustrating Report on "Some Croydon Gold Mines")

Between Murray's and Drawbridge's, some disturbance has taken place in the country rock and the reef, but more development is required before its character can be determined. If the country has been faulted, as shown in the section on Plan 14, then the country in the eastern portion of the lease is disturbed. The rock passed through in Drawbridge's shaft could not be examined, however, so the deductions are made on evidence which a personal examination might considerably modify.

Walsh's shaft could not be inspected, the information contained in the section on Plan 14 being obtained from various sources. At a depth of seventeen feet from the surface a leader was passed through in the shaft, which might be the Nancy Lee Reef or a cross leader. At 78 feet a "formation" was met with which is very probably a continuation of the Nancy Lee Reef found further north. The dip of this formation could not be ascertained, but is assumed to be easterly. If, however, it has a westerly dip, it might be a continuation of the zone of disturbed country, referred to above as occurring between Murray's and Drawbridge's. No opinion can be expressed other than that just given concerning the mining prospects at Drawbridge's and Walsh's Block, as both of these mines were closed down during the period of examination of the line of reef.

MINES SOUTH OF MURRAY'S (14 SOUTH BANNER BLOCK UNITED).

General.—Very little mining development has taken place south of the workings at Murray's mine, and all the prospecting shafts which have been sunk have failed to yield satisfactory results. Some shafts have been put down without finding any reef at all, while in others the reef has been found, but without any gold in it. Nearly all the prospecting has revealed a "formation" (with or without quartz), which is very persistent in its occurrence throughout this part of the field. The gold has been found in irregular masses of quartz or in veins that pinch out to threads, but the stone has not proved sufficiently rich to warrant operations being undertaken on a large scale.

From general considerations it may be taken for granted that—(1) the Golden Gate Reef hereabouts is exceedingly patchy: that (2) a formation is almost always present: and that (3) although rich patches of quartz may be expected to occur, nothing has been shown by developments to indicate any favourable outlook in the future. (*See* Plan 2, Sheet 3.)

No. 18 South Banner Shaft.—A section of the workings in this shaft is given on Plate 11, and shows the occurrence of the reef and formation. The fault shown thereon has a north-north-east strike, which, if extended, would pass to the east of Walsh's Block shaft. An enlarged section of this fault is also given on Plate 11, illustrating

[illegible]

Queensland.

DEPARTMENT OF MINES.

Geological Survey of Queensland.

(B. Dunstan, Acting Government Geologist.)

PUBLICATION No. 203.

GRAPHITE IN QUEENSLAND

WITH SPECIAL REFERENCE TO THE MOUNT BOPPLE GRAPHITE DEPOSITS.

WITH FIVE PLATES.

BY

B. DUNSTAN, F.G.S.,

ACTING GOVERNMENT GEOLOGIST.

BRISBANE:
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RAPHITE IN QUEENSLAND

WITH SPECIAL REFERENCE TO THE MOUNT BOPPLE GRAPHITE DEPOSITS.

◆

INTRODUCTION.

The following notes have been prepared with the object of making ilable all that is at present known concerning the occurrence of phite in Queensland. The principal deposits are at Mount Bopple, the Maryborough district, where the graphite has been found ficiently pure for commercial purposes, and where mines are now ng worked with a view of supplying the demand which has been ated for it.

Graphite occurs in other localities in Queensland, and in the lowing pages reference will be made to these and to the more portant foreign sources of supply. Notes will also be given on the ssing, uses, values, and production of the mineral.

THE GRAPHITE DEPOSITS AT MOUNT BOPPLE.

POSITION, ETC.

The Mount Bopple graphite mines are situated on the range close the North Coast Railway between Gympie and Maryborough, being ut three miles south-east of Netherby, and about the same distance th-east of Gundiah. The highest point on the Bopple Range is con Peak, 1,900 feet above sea-level, on which has been erected a onometrical staff. The peak, known as Mount Bopple, 1,800 feet h, is the most northerly one on the range, and is about three-rters of a mile distant from the Beacon Peak.

The two peaks, together with Mount Gundiah, which is about a e south of Beacon Peak, are connected by a low range having a th and south trend, and on both their eastern and western sides erous steep and rugged spurs lead down to the flat country at their es. It is on the spurs leading down from the gap between Mount ple and Beacon Peak that the graphite-bearing belt of country is ated. The position of this belt, together with other features, are n on the accompanying plan. (Plate 1.)

GEOLOGICAL FEATURES.

Burrum coal measures are the prevailing sedimentary rocks und the Bopple Range, and their intrusion by igneous masses has ulted in the strata being much crumpled and faulted.

Mount Bopple, the northern peak, is made up of syenite granite, and hornblende andesite, whilst Beacon Peak is con andesite and quartz felsite. The syenite is exposed on the we of the saddle connecting Mount Bopple and Beacon Peak, a outcrops on the surface about 60 feet away from a shaft su Simpson to prospect the graphite deposits on this side of t Granite and syenitic granite are exposed lower down the slope further north on some of the spurs leading down from Moun

Hornblende andesite is the predominating igneous roc eastern side of Mount Bopple, and in several places it is seen i with the coal measures. With other varieties of andesite exposed in many localities to the north of the range in the di Tiaro, about four miles distant, and about a quarter of a mi Tiaro, in the banks of the Mary River, a natural section association with coal measures. The intrusion of these igneo appear to have disturbed the sedimentary rocks throug district, and to have altered seams of bituminous coal to ant graphite.

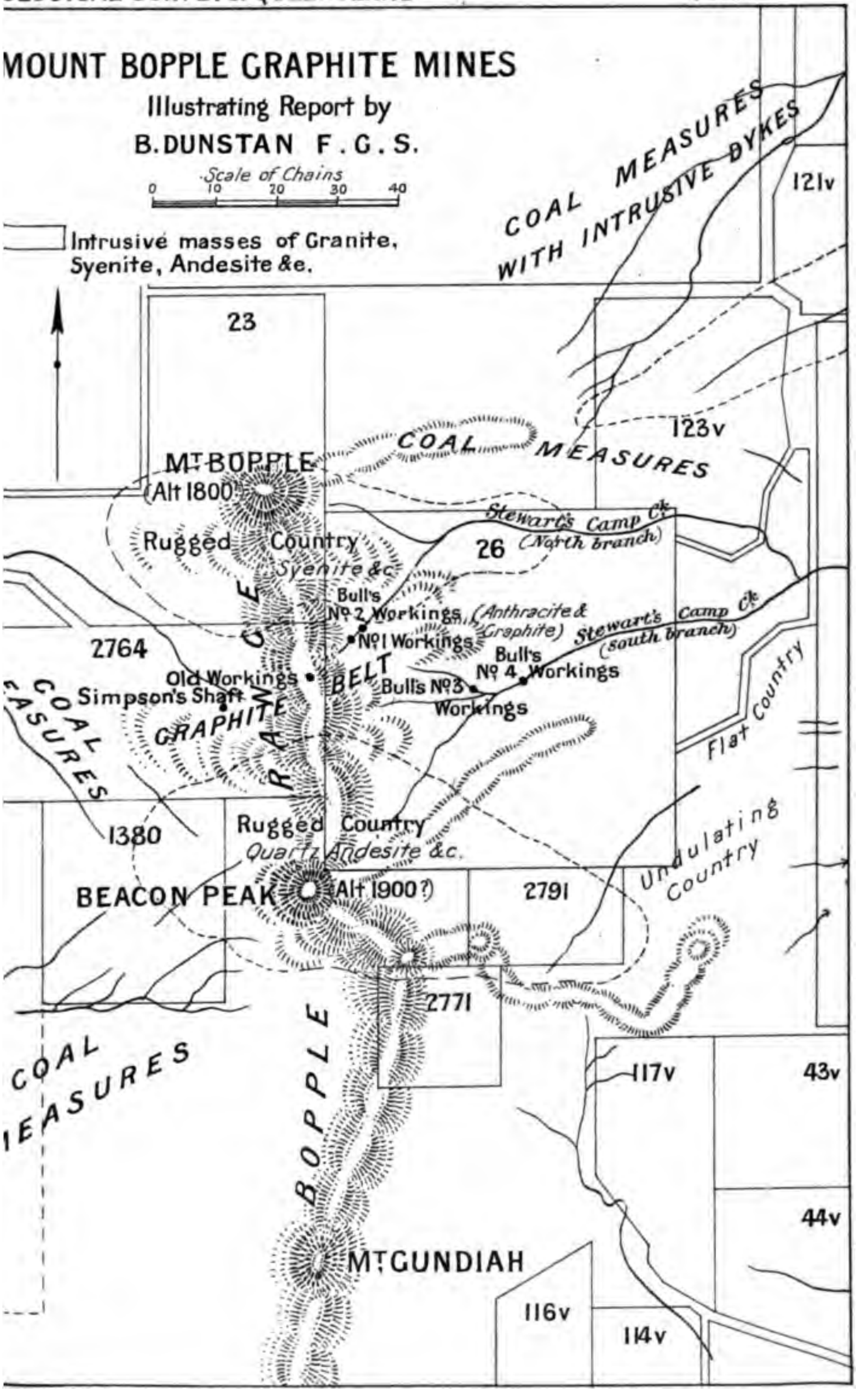
The occurrence of aplite was also observed at the grapl on the western slope of the range. At Simpson's shaft th found in the graphite in the form of small veins about an incl ness, which taper out to leaders, and gradually change to mica. Occasionally the hornblende of the andesite is found i of black cleavable crystals about an inch in diameter, and, the rumour that wolfram is found in this locality is due to th of this mineral.

The coal measures, containing bituminous coal seams, a in the country all round the mountains, and at Tiaro, Gutc Munna Creek, Kannighan Creek, and Redbank Creek outcr be seen which show the strata to be undulating, with occasi in which all bedding structure have been destroyed.

Between Mount Bopple and Beacon Peak the coal me severely contorted, but an easterly and westerly trend ca tinguished, this direction being the axis of a folding movem has taken place in the measures lying between the two n This is illustrated on Plate 2, Fig. 2.

On the western slope of the Range the bituminous coal altered entirely to graphite, while on the eastern slopes th almost imperceptible stages, has been changed to semi-b coal, anthracite, and graphite. In one locality the graphit anthracite, with six inches of graphitic clay shale between, t graphite, anthracite, shale, and associated rocks being quit and apparently undisturbed. Sections of this are repre Plate 3, Fig. 1, and Plate 2, Fig. 1. In the latter section the is divided into a large number of small bands interbedded wit

OLOGICAL SURVEY OF QUEENSLAND PLATE I



Illustrating Report on "Graphite in Queensland"

he anthracite is very lustrous and of good quality, but the are on an average only about an inch in thickness, whilst the graphite, six inches above, is dull and earthy, and shows no perle division into bands of varying quality. The beds above and are shales and sandstones, and there are no intrusive rocks in contact with either the graphite or anthracite. Probably the icite has been a coal of good quality, and that the graphite ally has been carbonaceous matter mixed with carbonate of iron. trusive masses of hornblende andesite in the vicinity might have d the change from bituminous coal to anthracite at the same that the carbon contained in the ironstone was changed into ite. Subsequent leaching would have removed most of the iron, g a residue containing about 50 per cent. of graphitic carbon. 3, Fig. 2, shows a section near Bull's graphite mines illustrating trusion of the graphite-bearing strata by dykes of hornblende te.

MINING OPERATIONS.

he work of exposing and developing the graphite deposits on the n slope of Mount Bopple are now proceeding at Simpson's mines, shaft has been sunk to prove the seams which are exposed on rface.

he position of the shaft is shown on Plate 2, Fig. 1, the sections shaft and the seams being represented on Plate 4. At the first ıg in the shaft (marked S. 1 on Plate 4, Fig. 1) a sample was ed from a seam of graphite four feet thick, and which on analysis d 27·10 per cent. of carbon and 69·20 per cent. of ash. At the l landing (marked S. 2) a 3-foot seam of graphite was sampled, as found to contain 32·28 per cent. of carbon and 62·40 per cent. ı. Another sample was taken from a 2-foot seam at the third ıg (S. 3) which yielded 18·32 per cent. of carbon and 76 per cent. . Other samples were taken from positions lower down in the and gave results somewhat similar to the above. The whole of ıalyses of the samples taken are tabulated on another page.

he seams which were sampled aggregate eleven feet of graphite, an average composition of 25·59 per cent. of carbon and 69·30 nt. of ash. Other bands of shale, aggregating 24 feet in thickcontain a smaller percentage of graphite, while there is about et of shale in which graphite is not present. Sections which have exposed in the vicinity of the above workings show that other ite seams are present interbedded with graphitic shales and tones, but their quality has not been ascertained.

he inclination of the strata in the upper portion of Simpson's is at an angle of about 45°, but nearer the bottom the angle of much steeper, and in one place is nearly vertical.

ome old workings, opened many years ago by Mr. C. S. A. Drain, ituated close to the gap between Mount Bopple and the Beacon

Peak. They show the graphite to be of the same general character as that exposed in the workings previously referred to, and they have the same alterations of graphite, graphitic shales, and graphitic sandstones. The rocks contain impressions of *Alethopteris australis* and *Phyllotheca*, and probably bear a close relation to the Burrum coal measures. Samples from the workings were obtained by Mr. W. H. Rands in 1890, who visited the locality when making a general examination of the geological features of the district.* A picked sample from here gave, on analysis, 6·3 per cent. of moisture and volatile hydrocarbons, 72·7 per cent. of carbon, and 21 per cent. of ash. Another sample taken from a number of bands in a section 36 feet wide yielded 7 per cent. of moisture and volatile hydrocarbons, 44·25 per cent. of carbon, and 48·75 per cent. of ash.

The workings at Bull's mines show that graphite occurs in several localities on the eastern slope of the range, but operations have been principally confined to four places. No. 1 Workings, situated in a ravine on one of the heads of the north branch of Stewart's Camp Creek, are in the vicinity of the line of contact of coal measures and an igneous rock mass. (*See* Plate 1.) The rocks consist of clay shales, sandy shales, and graphitic shales, and are much inclined. A seam of graphite, four inches thick, has been exposed in a short underlie shaft, and a sample taken from the face of the workings yielded, on analysis, 3·2 per cent. of moisture and volatile hydrocarbons, 16·3 per cent. of fixed carbon, and 78 per cent. of ash.

No. 2 Workings are in an adjoining watercourse, which also falls into the same branch of Stewart's Camp Creek. The sedimentary rocks here are shales, sandy shales, graphitic shales, and sandstones, together with a bed of graphite and a great number of bands of anthracite. Masses of hornblende andesite occur close to the workings, intrusions of which disturb the shales and sandstones and alter their character. The workings consist of a tunnel driven along the inclined seams of anthracite and graphite to a distance of 38 feet. A section of this tunnel is given on Plate 4, Fig. 1. The graphite from this tunnel contains 1·1 per cent. of moisture and volatile hydrocarbons, 74·1 per cent. of fixed carbon, and 24 per cent. of ash. A sample of the anthracite, picked from the bands which, altogether, make up about one-quarter of the whole of the five-foot seam, gave the following result:—

ANALYSIS OF ANTHRACITE BANDS, BULL'S MINE, MOUNT BOPPLE.

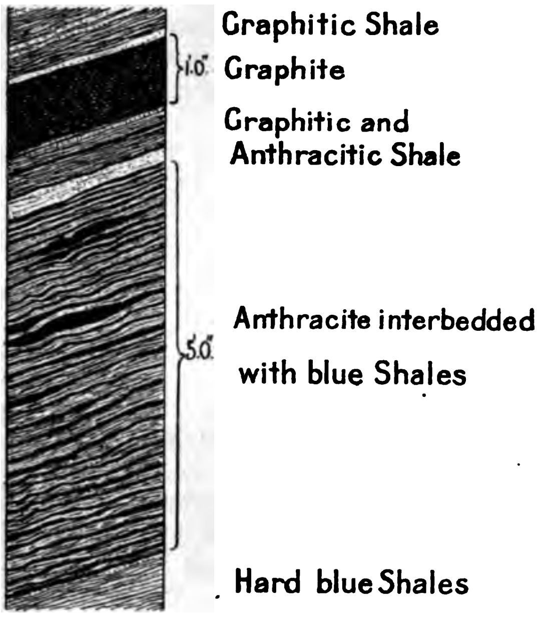
Moisture	1·2	per cent.
Vol. Hydrocarbons	3·3	,,
Fixed Carbon	90·9	,,
Ash	4·6	,
	100·0	per cent.

---

* Tiaro District: The Coal Measures, Neardie Antimony Mines, and Teebar and Culgoa Copper Mines, by W. H. Rands. By Auth.: Brisb., 1890, p. 8 G.S.Q.P., No. 59).

Sections at the Mount Bopple Graphite Mines

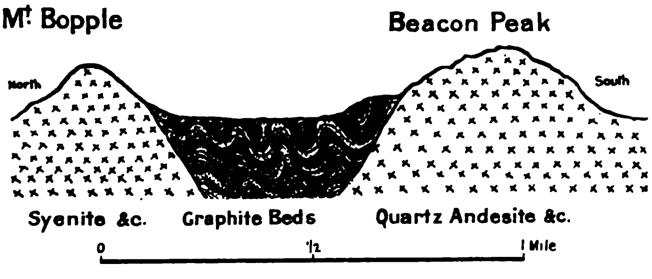
Fig. 1


Graphitic Shale
1.0
Graphite
Graphitic and Anthracitic Shale
5.0
Anthracite interbedded with blue Shales
Hard blue Shales

ction at Nº 2 Workings (Tunnel), Bull's Graphite Mine, Mt Bopple

Illustrating the occurrence of Anthracite with Graphite

Fig. 2



Section along the Bopple Range

Showing the crumpling of the Graphite-bearing Coal Measures between Mt Bopple and the Beacon Peak

No. 3 Workings are situated on the south branch of Stewart's Creek, at the position shown on the accompanying plan. (Plate They consist simply of some excavations in the bed of a water-e in which seams of graphite occur interbedded with the shales. t three feet of the graphite-bearing shales have been exposed, but urrounding features indicate the probability of other seams of ite being found if a prospecting shaft were sunk close to the nt workings.

At No. 4 Workings, which are lower down on the same water-e, a four-foot seam of graphite has been exposed, and proves to be rgest of those discovered on the eastern side of the range. The in the vicinity show several small graphite seams interbedded with s, and possibly others exist whose outcrops are covered by *débris.* ort tunnel has been driven into the four-foot graphite seam, a le from which yielded, on analysis, 3·2 per cent. of moisture and ile hydro-carbons, 16·3 per cent. of fixed carbon, and 78 per cent. h. A sketch section of No. 4 Workings is given on Plate 4, Fig. 2.

Other places in the vicinity of Bull's workings indicate the ence of several graphite deposits, and as there are here large areas n to be graphite-bearing, and many natural sections of rock sed which have not been carefully examined, seams of better ity will probably be found as prospecting operations are advanced.

TABLE OF ANALYSES OF MOUNT BOPPLE GRAPHITE.

o.	Moisture and V. H. C.	Mixed Carbon.	Ash.	COMPOSITION OF ASH.			
				Silica.	Alumina.	Lime.	Alkalies, &c. (by difference).
...	5·70	27·10	69·20	61·80	30·20	1·90	6·10
...	5·32	32·28	62·40	58·30	35·80	1·70	4·20
...	5·68	18·32	76·00	58·10	35·60	1·30	5·00
...	4·46	22·14	73·40	55·60	37·20	2·70	4·50
...	5·26	25·74	69·00	59·00	25·00	2·00	4·00
...	5·22	27·98	66·80	59·80	35·10	1·40	3·70
...	2·50	16·10	80·10	Ash is mainly Silicate of Alumina.			
...	3·20	16·30	78·00				
...	3·50	15·60	79·50				
...	2·80	46·30	51·10				
...	1·10	74·10	24·00				
...	2·40	10·80	82·80				
...	6·20	72·70	21·00				
...	7·00	44·25	48·75				
...	4·40	90·90	4·60				

NOTE.—A little iron and magnesia is present in all samples, but sulphur is absent

LOCALITIES FROM WHICH THE ABOVE SAMPLES WERE TAKEN.

No. 1. Simpson's shaft, No. 1 landing, 4-foot seam.

No. 2. Simpson's shaft, No. 2 landing, 3-foot seam.

No. 3. Simpson's shaft, No. 3 landing, 2-foot seam.

No. 4. Simpson's shaft, No. 4 landing, 1 foot 6 inch seam.

No. 5. Simpson's shaft, No. 5 landing, 6-inch seam.

No. 6. Simpson's shaft, sample from 6-ton parcel prepared for ket.

No. 7. Bull's No. 4 Workings, sample from 6-ton parce market.

No. 8. Bull's No. 4 Workings, from working face in at No. 4 Workings.

No. 9. Bull's No. 3 Workings, from outcrop in waterc No. 4 Workings).

No. 10. Bull's No. 1 Workings, from 4-inch seam tunnel.

No. 11. Bull's No. 2 Workings, from 1-foot seam in 38

No. 12. Bull's No. 2 Workings, from excavation in b course.

No. 13. Drain's old workings, picked sample by Mr.

No. 14. Drain's old workings, average sample from bedded with shales, in a 36-foot section (by Mr. Rands).*

No. 15. Bull's No. 2 Workings, bands of anthracite l graphite.

OTHER QUEENSLAND GRAPHITE DEPOSI

Mackay District.—The deposits of graphite in Select 777, parish of Eton, was inspected in 1896 by Mr. A. Gil who furnished a report (unpublished) concerning their occ states that the graphite is associated with beds of shales an traversed by what appears to be both interbedded and intr of igneous rocks.

In one locality on Scrubby Creek, the graphite has l just above the level of the watercourse, and a prospectin been driven into it for a distance of 80 feet. In thicknes averages about 18 inches, and has a perceptible dip to th while further along the bed of the gully the vein has a over four feet. About 20 tons of this graphite was bagge mental purposes, but the results of the trial have not been

Another thin vein of graphite is exposed about eight f one just referred to, but nothing has been done to determ ness or quality. Further up the course of the gully ano graphite associated with black shale is exposed, and i contact with an intrusive rock. Nearer the head of the gu beds of shale exposed, which have been disturbed by thes whilst indications of the presence of graphite are to b several places near the same watercourse. In Palm-tree north of Scrubby Creek, graphite is to be found under s tions, and in several other localities outcrops of graphite s shales are also known.

The western side of Selection 777 consists of basalt lying shales, and the flanks of Homebush Hill, in Select made up of horizontally-bedded shales with interbedded graphite, none of which, however, have been examined.

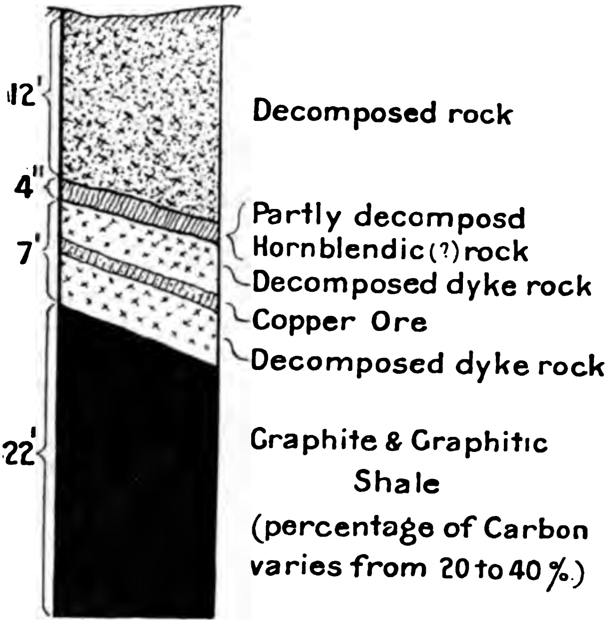
---

* *Loc. cit.* (G.S.Q.P. No. 59), p. 4.

The graphite from the localities in this district, according to Mr. Maitland, contains from 15 to 70 per cent. of graphitic carbon, and at the time he made the examination considered the deposits to be worth further attention.

CLONCURRY.—Graphite was discovered near Cloncurry in 1880,* but for many years no further exploration has been made of it. Quite recently, however, samples of graphite have been received from Hampden, near Cloncurry, where a large deposit exists. Most of the material is of an inferior quality, but some portions contain 40 per cent. of carbon. A shaft sunk to prospect for copper penetrated a large mass of graphite of unknown dimensions, of which Mr. Jas. Long furnishes the following section:—

Section of Graphite Deposit, Hampden.


12'
4"
7'
22'
Decomposed rock
Partly decomposd Hornblendic (?) rock
Decomposed dyke rock
Copper Ore
Decomposed dyke rock
Graphite & Graphitic Shale (percentage of Carbon varies from 20 to 40 %.)

STANTHORPE DISTRICT.—Graphitic slate is present in the Silver Spur Mine at Texas,† but its quality does not warrant any consideration being given to it as a commercial product. At Wilson's Downfall, on the New South Wales border, graphite occurs in abundance; but up to the present the deposits which have been found have proved to be inferior in quality. Much requires to be done, however, before any definite conclusion can be arrived at as to their value.

---

* Annual Report of the Department of Mines for 1880, p. 31.

† Notes on Tin, Copper, and Silver, in the Stanthorpe District, by L.C.B. By Auth.: Brisb., 1904, p. 31 (G.S.Q.P., No. 191).

Cape Upstart.[*]—Deposits of graphite are known at Cape Upstart, on the coast between Townsville and Bowen, but they have not been developed to any extent. Prospecting operations which are now in progress show that the seam of graphite varies from four to eight feet thick, and is in coal measures close to a mass of igneous rock. The quality appears to be similar to that of the graphite at Mount Bopple.

Gympie.—Graphite is intimately associated with the reefs which traverse the slates of this goldfield. The quality is very poor, and of no commercial value.

Croydon.—The granitic and felsitic rocks prevailing on this goldfield contain small quantities of graphite.[†] In the granite it is found as irregular inclusions, and is much contaminated with clay. In the felsites it is in the form of flakes, very pure in quality, but finely disseminated.

Hamilton Goldfield.—The quartzites associated with the reefs on this goldfield contain a quantity of graphite in the form of flakes.[‡]

Normanby Goldfield (Reid's Creek).—A large deposit of graphite has been found on Rosslyn Run, near Greenbank, but no authentic information has been obtained concerning its quality.[§]

Yorkey's Goldfield.—In Campbell's reef on this field graphite is associated with pyrites and quartz.

New Guinea.—"The presence of graphite or plumbago has been demonstrated over nearly the whole of the known portion of the Possession, but always as an accessory constituent of the schists; in some cases it occurs in such a quantity as to give a distinctive character to the rocks. In the most graphitic of the schists, although the quantity is proportionally large, to remove the impurities (chiefly quartz) by washing or other means would be too costly to be remunerative."[‖]

NOTES ON GRAPHITE IN NEW SOUTH WALES.

A deposit of graphite-bearing shale is exposed near Underwood Station, about twelve miles from Wilson's Downfall, near the Queensland border. It is interbedded with sedimentary rocks which have been altered by an intrusive mass of granite. A trial has been made of the graphite by the Springfield Facing Company, Massa-

---

[*] Mineral Wealth of Queensland, by R.L.J. Brisb.: By Auth. 1888, p. 67 (G.S.Q.P., No. 48).

[†] Some Croydon Gold Mines, by B.D. Brisb.: By Auth., 1905, pp. 9-10 (G.S.Q.P., No. 202).

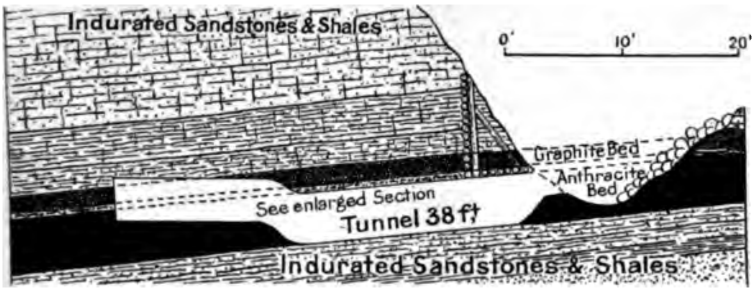
[‡] The Hamilton and Coen Goldfield, by L. C. Ball. Brisb.: By Auth., 1901, p. 4 (G.S.Q.P., No. 163).

[§] Annual Report of the Department of Mines, 1887. Brisb.: By Auth., 1888, p. 54.

[‖] Geological Observations in British New Guinea, by A. Gibb Maitland. Brisb.: By Auth., 1892, p. 32 (G.S.Q.P., No. 85).

Sections at the Mt. Bopple Graphite Mines

Fig. 1

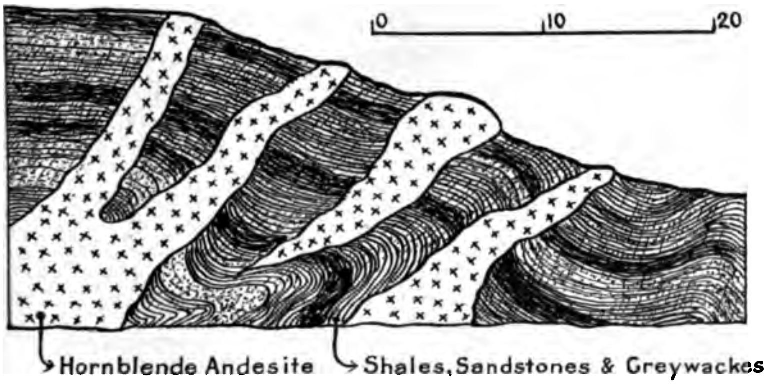


Section of No. 2 Workings Bull's Mine

Showing the position of the beds of Sandstones,

Shales, Graphite and Anthracite

Fig. 2



Section near Bull's Graphite Mines

Showing the intrusion of the Graphite-bearing beds

with Hornblende Andesite

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containing 53·8 per cent. of carbon, the inferior 31·72 per cent. The dressed article contains 89·2 per cent. of carbon, and the waste material from 22·3 to 36·8 per cent.

CUMBERLAND, ENGLAND.—The old Borrowdale graphite mines have been practically idle for the last forty years, and are exhausted. The graphite is in the form of nests and lumps, and occurs in veins of quartz and calcite which traverse greenstone porphyry. The graphite produced from these mines was a fine flake variety, used principally in the manufacture of lead pencils.

BUCKINGHAM, QUEBEC.—In these Canadian mines the graphite is disseminated in gneiss, &c., the deposits varying in thickness from a few feet to 25 feet. The proportion of graphite to rock is from 10 to 50 per cent., but in one particular bed, 20 feet in thickness, the average yield is 20 per cent. of graphite. The raw graphite has the following average composition, and considerable quantities of this rock has been mined:—

ANALYSES OF BUCKINGHAM GRAPHITE.

Hygroscopic moisture	1·740	per cent.
Soluble in HCl	19·467	,,
Insoluble	56·408	,,
Carbon	22·385	,,

ONTARIO.—Considerable quantities of graphite are obtained at the mines at Renfrew, but it is stated that the industry is only carried on profitably when the percentage of graphite in the gangue is more than 15 per cent. At the Black Donald Mine the total amount of graphite in the product is about 65 per cent., of which about 45 per cent. is amorphous, the remainder being the flake variety. Some portions of the deposit yield a graphite containing as much as 80 per cent. of carbon, whilst low-grade portions contain about 25 per cent. of carbon. The graphite occurs as a vein in crystalline limestone, and is associated with seams and pockets of chlorite, and is close to schistose rocks.

At the McConnell Mine, near Perth, Lanark County, the product, which is in a flake form, contains much less carbon than that at the Black Donald Mine. The country rock is limestone, and the graphite occurs in zones or veins several hundred feet long.

BOHEMIA.—The Schwarzbach-Kruman deposits are lenticular in shape, and are associated with limestones. The graphite is much desired for pencils, and in being compact and without foliation is admirably suited for this purpose. The refined graphite contains from 50 to 60 per cent. of carbon.

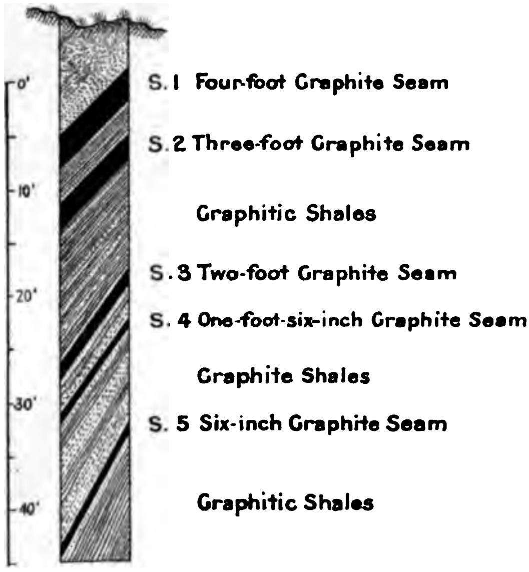
STYRIA.—The deposits in this locality are associated with strata belonging to coal measures. The graphite produced contains from 73·8 to 88·5 per cent. of carbon, and analyses show it to have the following average composition:—

ANALYSES OF STYRIAN GRAPHITE.

Alumina	6·12	per cent.
Silica	13·04	,,
Carbon	77·95	,,

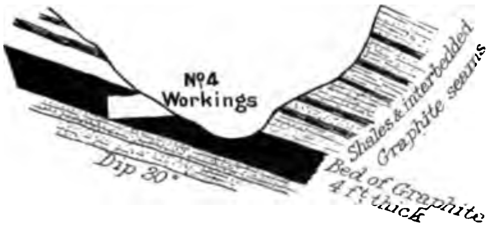
Sections at the Mount Bopple Graphite Mines

Fig. 1


0'
10'
20'
30'
40'
S. 1 Four-foot Graphite Seam
S. 2 Three-foot Graphite Seam
Graphitic Shales
S. 3 Two-foot Graphite Seam
S. 4 One-foot-six-inch Graphite Seam
Graphite Shales
S. 5 Six-inch Graphite Seam
Graphitic Shales

Section of Shaft at Simpson's Mine
Showing the position of the Graphite Seams
(See accompanying table for analysis)

Fig. 2


Nº4 Workings
Shales & interbedded Graphite seams
Bed of Graphite 4 ft thick
Dip 30°

Section across the South Branch of Stewart's Camp Creek
Showing Nº 4 Graphite Workings at Bull's Mine

Illustrating Report on "Graphite in Queensland"

As the silica is the principal impurity, the graphite is very refractory, and in consequence is in great demand for the manufacture of crucibles.

IRKUTSK, SIBERIA.—At the Batugol mines the graphite is of very fine quality, and much used in pencil-making. It occurs as fibrous lumps in veins traversing granite and diorite, and is closely associated with an altered limestone.

TICONDEROGA, NEW YORK.—The mines at this locality are worked by Dixon, and are the principal source of supply in the United States. The rock as mined averages ten per cent. of graphite, but deposits are said to be worked which yield not more than six per cent. These deposits are stated to be "elliptical chimneys in gneiss, which have been filled with calcite and graphite."

AUSTRIA.—The Northern Moravian mines produce a graphite containing 53 per cent. of carbon, and 44 per cent. of ash.

SOUTH DAKOTA.—The graphite found at Rockford, in this State, contains from 26 to 41 per cent. of carbon, which, without being accompanied by other higher grades, is considered too low in quality to profitably mine.

MEXICO.—Mexican graphite varies from 40 to 50 per cent. in carbon contents.

CORONA, U.S.A.—"Corona" graphite contains 57 per cent. of carbon and about 40 per cent. of ash. It is the material now being used by the Southern Pacific Railway Company for paint, fine lubrication, foundry facings, and hot-box grease.

INDIA.—Samples have been submitted to the Imperial Institute from the Chatisgarh district, and were found to contain respectively 40·95, 37, 79·91, 69·67, 63·70, and 54·73 per cent. of fixed carbon. The sample containing 79·91 per cent. of carbon was not considered sufficiently pure to be used in the making of crucibles, and could only be utilised for stove-polishing and similar purposes, and would be worth about £10 per ton. The remaining samples, except that containing 69·67 per cent. of carbon, were said to be of very little value. It is further stated that the supply of graphite having less than 85 per cent. of carbon was very much in excess of the demand, and that in consequence such quality could only command a low price.

ARTIFICIAL GRAPHITE.

Artificial graphite is manufactured by the International Acheson Graphitic Company, Niagara Falls, New York, U.S.A. The method of its manufacture was discovered by Mr. Acheson while developing some experiments in the making of carborundum, a substance having a hardness greater than emery, and now used extensively as an abrasive.

The silicon which is combined with the carbon in carborundum is vaporised at a very high temperature, and the carbon, in the form of graphite, remains as an infusible residue. Additional experiments showed that anthracite coal can be converted into graphite.

In conducting the operations of converting anthracite into graphite, the anthracite is heated for a number of hours in an electric furnace with an expenditure of energy equivalent to 1,000-h.p. "The furnace consists of a long narrow trough made of fire brick, and lined with some suitable refractory material. At each end of the trough there is a terminal, built of large carbon rods to which are connected the cables conveying the current. The trough is filled with anthracite coal in which is bedded carbon rods to make electrical connection between the terminals. The temperature is raised to a point where the carbon is first converted into carbides of the various constituents of the ash, which in anthracite coal is very evenly distributed throughout the mass, and is then carried still higher to a point at which the carbides are decomposed, the principal constituents of the original ash, silicon, iron, and aluminium being driven off as vapours."

"The residue removed from the furnace is carbon in the form of graphite, perfectly free from any trace of amorphous carbon. The purity of the graphite depends on the temperature to which it has been raised, and for commercial purposes it is found sufficient to keep the ash contents below ten per cent. When reduced to this percentage the ash still remaining in the graphite is practically as inert as the graphite itself. When removed from the furnace the graphite is ground up and the grades suitable for various purposes separated."—(Pamp.—Acheson Co.)

CONCENTRATING AND DRESSING GRAPHITE.

The means employed in dressing the graphite for market comprise operations in crushing, screening, air jigging, and sizing, and the operations at the Black Donald and McConnell mines, previously referred to, may be taken as examples.

At the McConnell Mine the operation is as follows:—"After coarse crushing and drying, the ore is reduced to a fine size and screened several times to remove a considerable proportion of the limestone gangue as dust. A cleaner separation of the intermixed rock is effected by concentrating in pneumatic jigs, and the concentrates are then ground in a series of millstones. The polished and enriched flake discharged from the last stone undergoes wet buddling in small vats, which finish the work of concentration, after which the graphite is again dried, preparatory to the final grading in revolving screens into two or, when desired, more sizes, the coarsest being from fifteen to twenty mesh size. On account of the low content of carbon in the crude ore, this elaborate scheme of concentration has been adopted in order that the saving should be as high as possible. The flake product is of high grade suitable for crucible stock. The capacity of the McConnell refinery is from 15 to 20 tons of ore per day."—("Min. Industry," 1902.)

The Black Donald refinery has a capacity of 15 tons per day, and uses a wet process of concentration with large buddles. "All of the material but the tails is dried either in an electric-heated or ordinary fire-heated revolving cylinder, sized, and then ground between millstones, which pulverise the gangue and amorphous graphite and merely polish the flake. After grinding, the product is passed through a series of revolving screens of gradually decreasing mesh, by which four sizes of flake are separated out, then a mixed flake and amorphous grade, and finally four or more sizes of amorphous graphite. The first flake is the coarsest and cleanest product, running about ten-mesh size and 96 per cent. C.; the remaining grades of flake decrease in size, but all are over 90 per cent. pure. The amorphous grades are in powder form and carry from 54 to 62 per cent. C. The limestone remaining with the graphite after buddling pulverises more readily than the graphite, and in the screening separates out from the graphite as dust."

"This mine is exceptional, both as regards uniformity and quality of the graphite, and size of the deposit. Since the erection of the refinery practically all the ore may be converted into valuable products, chief of which are the grades of flake for use in the manufacture of crucibles."—(Mineral Products, 1902.)

In the "Mineral Resources" for 1902, p. 976, it is stated that "there are two methods of concentrating graphite from its ore, the wet and the dry. No mill has adopted the dry or air method in its entirety, on account of the gravities of the component parts of the ore being so close to one another. Several pneumatic processes have lately proved a partial success, but they have been of limited application on account of the inability to remove the small scales of mica which occur in some of the deposits. The wet or water method of concentration has been developed to a marked degree of efficiency, and is the one now used by the operative companies (*sic*). The general method of procedure is to crush the ore, stamp it wet, separate coarsely by stationary buddles, the concentrates being dried and further treated with buhrstones and screens."

At the Buckingham mines the mill has a capacity of 20 tons per day, treats 25 per cent. ore, and gives daily about three tons of a finished product, which contain 60 per cent. of graphite. The ore, after crushing and drying, is treated on a Brumell separator, a machine designed to clean the graphite by floating it on the surface of water.

A process of treating the graphite consists in grinding the ore, and then passing it through sieves having from 120 to 150 meshes to the inch, afterwards adding steatite and alum. The average composition of this mixture would be eighty parts of graphite, fourteen parts of steatite, and six parts of alum, but this is subject to variation according to requirements. It is said that a graphite thus treated will bind together, which, before treatment, will not do so, and that a graphite which will only bind to a limited degree is much improved by the treatment.

Finely-powdered graphite, after washing, is sometimes purified by mixing fourteen parts of it with one part of potassium chlorate and two parts of 66° sulphuric acid, heating on a water bath for some hours, and then washing again and roasting to a red heat. This removes most of the substances which cannot be removed in the ordinary washing processes. Silica, if present, and if desirable to remove, necessitates supplementary treatment with hydrofluoric acid.

In the Mount Bopple graphites, the amorphous condition of the carbon, and the presence of the silica and clay in a fine state of division, suggests that a difficulty would be experienced in treating it by any method of mechanical concentration, and that in consequence hand-picking would have to be relied on to grade it up to a marketable quality.

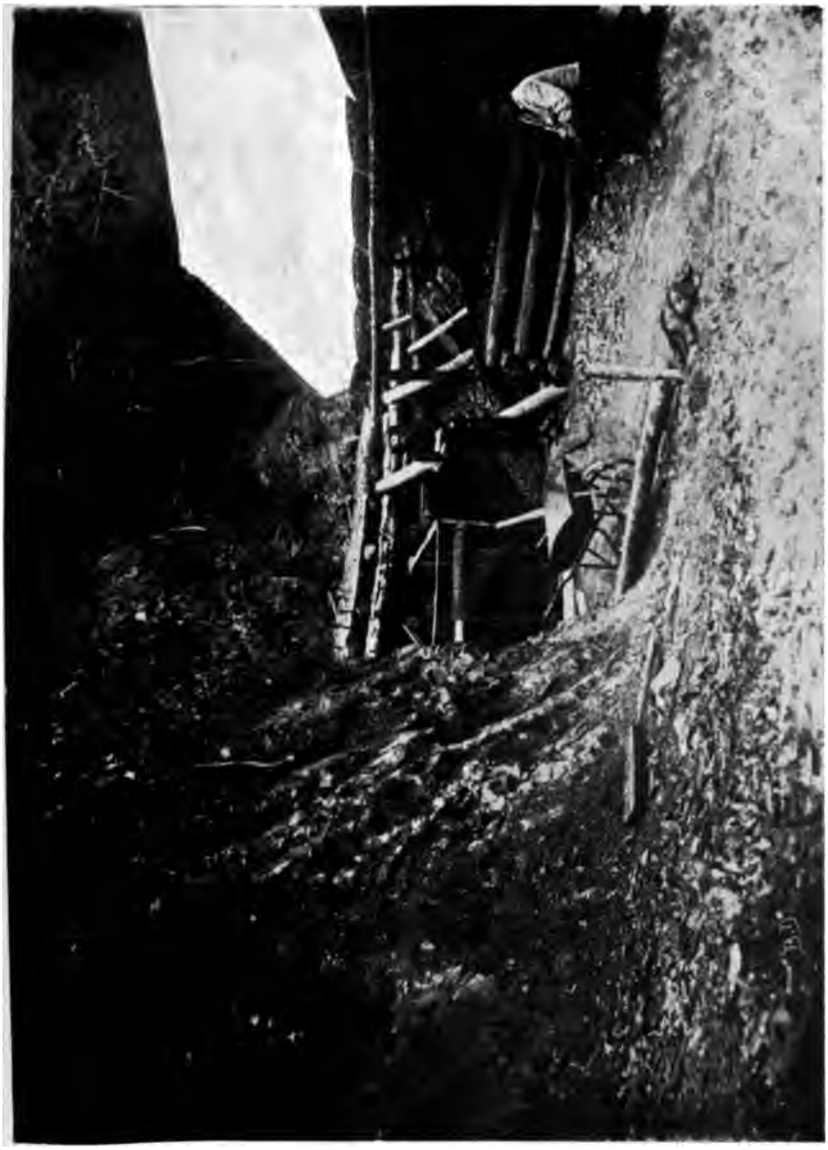
USES OF GRAPHITE.

Graphite is used in the manufacture of crucibles, stove polish, foundry facings, paints, pencils, steam-packing, dry batteries, and in electrotyping and chemical operations.

Lubricants require a high-grade flake graphite, none but the very best material being used for this purpose. Many processes have been devised for utilising the graphite in this way, but the most recent method, which gives promise of being successful, consists in saturating the powdered graphite with oil, and then suspending it in another oil which will not mix with that used in the saturation of the graphite. Mixed with grease, the graphite forms, ordinarily, a lubricant for journals, but the new method of preparation with oil will enable it to be used extensively in the lubrication of cylinders. Mixed with an equal proportion of grease, the graphite is used as a hot-box "cooler."

In the manufacture of crucibles, the flake form is required, and usually a very high-grade quality is indispensable. The flake variety has a tendency to bind together when worked up into articles, whilst the amorphous kind has not this property. Intermediate qualities, in having some of the properties of flake graphite, may be used in the manufacture of crucibles, but they will not stand more than one heating, and have to be crushed and moulded again. When the material of which the pots are made is too coarse, the pots are found to be porous, and if too fine, they are very liable to crack. Graphite which has only a slight binding property may be improved by treating with alum, &c., in the manner mentioned above.

Crucibles of good quality (as manufactured by Dixon) contain 50 per cent. of carbon, 33 per cent. of clay, and 14 per cent. of sand, but it is necessary to first obtain the graphite very pure and mix the



SIMPSON'S GRAPHITE MINE, MOUNT BOPPLE

(NEAR THE NETHERBY RAILWAY STATION).

substances with it afterwards. Raw graphite cannot, as a rule, be used for this purpose on account of the impurities it contains, although in the case of the Styria graphite referred to, the composition of the raw article shows that none of the silica and alumina would require to be removed as impurities, and that it would only be necessary to add sufficient clay and silica to make up the proportion required of those ingredients in the manufacture of crucibles.

"The material for making crucibles is sieved through screens containing from 40 to 100 meshes to the inch. The clay should be refractory, and the sand is passed through a forty-mesh screen. The clay is made into a thin paste with water, and sand and graphite are mixed in, and the dough is then passed several times through a pug-mill, after which it is tempered for several weeks in a damp place. Weighed lumps of the tempered dough are then kneaded and moulded on a wheel, which is considered to be better than simple pressing, as the graphite flakes are arranged tangentially and bind the mass better. The crucibles are placed in plaster moulds and left for three hours, during which time the plaster absorbs part of the moisture; they are then dried for a week at a temperature of 70° to 80° Fahr., and burned in a common pottery kiln, which is first fired with anthracite coal and afterwards with long-flaming wood. The burning takes a week, the temperature reaching about 1,350° C."—("Min. Industry," Vol. 2 (1893), p. 341.)

Stove polish, foundry facings, and electrotyping requires a low-grade graphite, and the amorphous variety is principally used for such purposes. In Canada the graphite used for foundry facings is only considered good when it contains 50 per cent. of carbon.

Pencils are made from "flakeless" graphite, but for this purpose the material must be very fine in grain and of the purest quality. The Batugol mines at Irkutsk, in Siberia, are said to produce a very fine quality of graphite for lead pencils.

Its use as moulds in metal-casting is also recommended as a substitute for iron, and is supposed to have some property which makes it specially suitable for this work. As a substitute for white and red lead it is stated to give great satisfaction, and in using it as a cement for pipe joints the iron is said to remain clean, even though the faces are exposed for a considerable time to the action of steam.

Graphite is very extensively employed in the composition of paints, some manufacturers using a low-grade article, while others consider that a high-grade graphite is more suitable. The paints on the market made from various natural graphites contain 50 per cent. or less of graphite, the other portion being made up of silica, oil, &c. It seems, however, that the manufacturer requires a graphite of good quality to operate upon, and would not think of using a natural graphite unless it contained considerably more than 50 per cent. of carbon.

The consumption of graphite for the various uses to which it is applied is tabulated below, from which it is seen that crucibles absorb more than half the whole of the production:—

Crucibles	55 per cent.
Stove polish	15 ,,
Foundry facings	10 ,,
Paints	5 ,,
Other uses	15 ,,
	100 per cent

GRAPHITE PRODUCTION AND VALUES.

In Australia the imports and production of graphite (which is also classed under plumbago and black lead) are not definitely known, but the following returns are furnished from all the statistical references available:—

Victoria.—Imported 555 tons during the four years, 1899 to 1902 (value £5,543, or about £10 per ton).

New South Wales.—Imports (no returns). Produced in 1894 16 tons, valued at £68; and in 1896, 80 tons, valued at £160.

Queensland.—Imported 113 tons during the six years, 1899 to 1904, value £3,154 (or about £26 10s. per ton).

South Australia.—Imported 19 tons during the year 1903, value £294 (or about £15 9s. per ton).

Tasmania.—Imported 8 tons* during the two years, 1901 and 1903, value £212 (or about £26 10s. per ton).

Western Australia.—The value of the imports during 1901 was £46.

The United States consumes almost all the natural graphite produced in that country, and with England absorbs about 80 per cent. of the whole of the higher grades produced in all parts of the world.

The production of graphite in the United States, during the year 1902, amounted to (*a*) 2,000 tons of refined graphite, valued at £20 per ton; (*b*) nearly 4,700 tons of amorphous graphite, valued at £2 15s. per ton; and (*c*) over 1,000 tons of artificial graphite, valued at £22 10s. per ton.

From this an opinion may be formed of the value of Queensland graphite as an article of export. At all the localities in Queensland where graphite exists in quantity, only the amorphous variety has been found, and this could not be expected to realise more than the prices quoted for the same variety in the United States. In England the same prices prevail.

As an article of trade within the Commonwealth however, it has decidedly an advantage over the imported graphite of the same class, and the demand for it in connection with foundry work will certainly increase when once those who are using the imported article can be persuaded to give the Queensland product a trial.

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* Estimated.

By Authority: George Arthur Vaughan, Government Printer, William street, Brisbane.

Queensland.

DEPARTMENT OF MINES.

Queensland Geological Survey.
(B. Dunstan, Acting Government Geologist.)
PUBLICATION No. 204.

THE WEST MORETON (IPSWICH) COALFIELD
SECOND REPORT ON.

(With Special Reference to the Bundamba District.)

WITH 2 MAPS, 1 PLATE, AND 9 FIGURES.

BY

WALTER E. CAMERON, B.A. (Cantab.),
ASSISTANT GOVERNMENT GEOLOGIST.

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THE WEST MORETON (IPSWICH) COALFIELD

WITH SPECIAL REFERENCE TO THE BUNDAMBA DISTRICT.

SECOND REPORT.

Chapter I.—General.

I.—INTRODUCTION: PRODUCTION AND PROSPECTS.

The West Moreton Coalfield is at present the chief producing coalfield of the State, its importance being due, in the first place, to the generally useful character of its coal for ordinary commercial purposes, such as marine and land steaming, coke-making, blacksmithing, and gas-making; and, in the second place, to the proximity of the field to the chief industrial centre and most important shipping port of the State. This latter circumstance will always be an important and favourable factor in the future prosperity of the field, as it will command an easily accessible and constantly growing market, where less favourably situated fields can only compete under the disadvantages of higher freight charges for transport from the mine.

During the last five years the Ipswich Field has turned out more than 75 per cent. of the total coal production of Queensland; its average annual output for that period having been a little under 400,000 tons. This represents a value to the Ipswich district annually of about £120,000.

The diagram shown in Fig. 1 gives a graphic representation of the important part played by the Ipswich and Darling Downs fields combined in the total output of the State during the last twenty years. As the returns from these two districts have not been kept separate, it is not possible to show those from the Ipswich Field alone; but, as the figures for the former district constitute only about 5 per cent. of the total of the two combined, the diagram would not be materially altered by their exclusion.

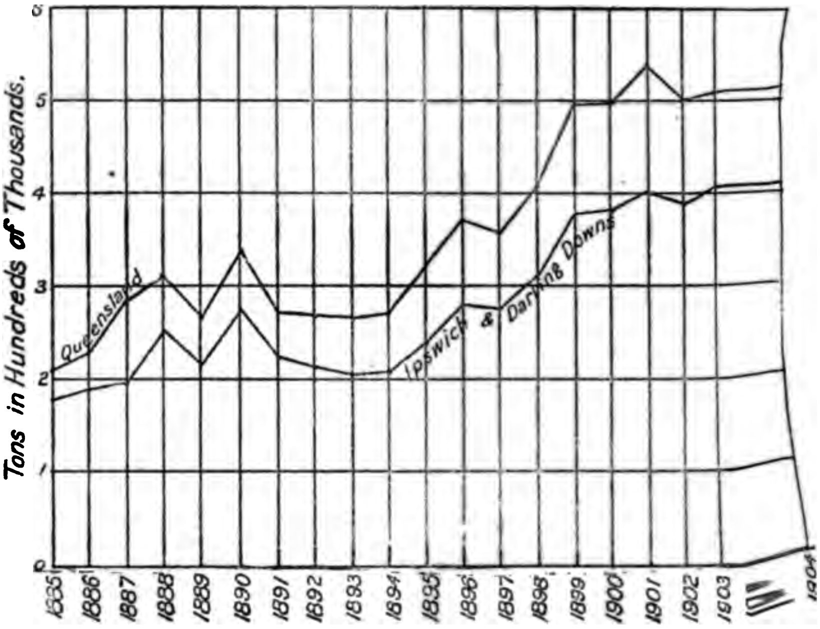

FIG. 1.—PRODUCTION OF QUEENSLAND COAL DURING TWENTY YEARS ENDED 1904.

As shown by the diagram and Table I., the annual output of coal from Queensland mines increased during the years 1894 to 1899 from 270,705 tons to 494,000 tons, or by over 80 per cent.; while for the succeeding five years the increase of output did not amount to 4 per cent. This sudden check to expansion was no doubt primarily due to the disastrous drought, the effects of which have paralysed Queensland trade generally during the last five years; and, as a natural consequence, greatly curtailed the coal consumption of the State. The rapid increase of demand shown by the former five-year period led to the opening up of a number of new collieries, especially along the southern extension of the outcrop of the Aberdare seam, during the latter five-year period; while the increase of competition thus brought about was not met by any corresponding increase in the demand for coal. The consequence has been a glut of the market, so that at the present time the output necessary to keep the mines now opened up in full work is in excess of the demand. As a consequence, nearly all the pits are periodically idle.

Efforts have been made to meet this expanding production by working up an export trade to foreign countries; but, so far, without much success. The coal is of a brittle character, and, with the sure to weather and rough treatment inseparable from such a le, becomes quickly converted into slack. It consequently cannot expected to compete with the durable coals of the Newcastle rict, which are even more favourably situated as regards shipping ilities for such a trade.

TABLE I.—SHOWING PRODUCTION OF QUEENSLAND COAL FOR 20 YEARS ENDING 31ST DECEMBER, 1904.

Year.	Queensland.	Value.	West Moreton and Darling Downs Coalfields.	Value.
	Tons.	£	Tons.	£
5	209,698	87,228	180,744	71,258
6	228,656	95,243	189,608	72,054
7	283,813	97,460	193,286	71,851
8	311,412	127,947	254,778	98,851
9	265,507	121,118	217,240	195,202
0	338,344	157,077	276,063	120,476
1	271,603	128,198	222,766	97,757
2	265,086	123,308	215,535	91,798
3	264,403	125,340	204,429	86,582
4	270,705	114,593	207,672	81,201
5	323,068	132,530	239,712	89,150
6	371,390	154,987	280,094	106,740
7	358,407	139,889	277,172	97,411
8	407,934	150,493	310,444	103,927
9	494,009	175,715	373,655	127,305
0	497,132	173,705	379,504	126,425
1	539,472	189,877	420,500	139,860
2	501,531	172,286	390,603	127,851
3	507,801	164,798	403,462	124,479
4	512,015	166,536	408,186	124,339

Table II., the figures for which were kindly supplied to me by the mmissioner for Railways, shows the amount of coal railed from Ipswich district for consumption in various industries in Brisbane. shows that the Ipswich district depends most of all for its market the employment of the coal for marine steaming purposes by amers calling at the port of Brisbane. Beside the amount shown in table, about 20,000 tons are annually despatched by river from the rth Ipswich district for bunker purposes, so that the demand for is purpose is seen to have fluctuated during the last five years tween 140,000 and 170,000 tons annually. Probably another ,000 tons is despatched from the North Ipswich district for various arkets or in the form of coke, but the exact figures are not to hand.

BLE II.—SHOWING CONSUMPTION IN VARIOUS INDUSTRIES OF COAL RAILED FROM THE IPSWICH DISTRICT FOR FIVE YEARS ENDING 1904.

(Figures supplied by the Commissioner for Railways.)

Year.	Railway Purposes.	Bunker.	Cargo.	Gas and Meat Works.	Totals.
	Tons.	Tons.	Tons.	Tons.	Tons.
... ...	46,349	122,073	40,301	19,168	227,891
... ...	50,173	147,025	42,068	9,282	248,548
... ...	47,604	130,197	31,976	8,652	218,429
... ..	48,006	127,011	60,034	7,502	242,553
... ...	56,775	121,765	76,017	7,036	261,593

The establishment of smelting works to treat the iron Queensland coast seems to be the only industry that wou to give any prospect of a rapid expansion in the cons Ipswich coal. Several of the seams make first-rate coke, an would be as conveniently situated as any others in Que economical treatment of these ores. The metallurgical in the most lavish consumers of coal of any, and until industries are established in Southern Queensland no se of the coal resources of the Ipswich district need be fe the revival of trade consequent on better seasons, and increase of shipping to be expected from a port like B demand for coal from the Ipswich district may be expected increase, and the present slackness of the trade disappea low prices that may be looked for henceforth will proba the opening up of new ventures, such as have caused a plet during the last five years.

II. LOCALITIES WORKED FOR COAL.

The majority of the mines are in two main districts. productive—the Bundamba district—supplies over three-fo coal turned out from the field, and covers an area of abou miles, lying mainly to the south of the Brisbane-to-Ipsw line, between Six-mile and Bundamba Creeks, and from th miles east of Ipswich. It affords the main steaming coals bunkers at Brisbane and used by the Railway Department tive purposes. The second important district lies to the Bremer River, immediately north of the town of Ipswich, a worked over an area about three miles in length by breadth. Its seams furnish the whole of the coke manufac field, but there are also some good steam, blacksmithing, a Besides these two main districts, there are the more dista of Walloon, Rosewood, and Purga, lying to the west a Ipswich, and furnishing a coal of a distinct character. richer in volatile hydrocarbons, and gives a much larger p gas in the gasworks retorts, where it is chiefly consume mapping of the field has shown that these seams occur in beds of the coal series than those containing the coals of N and Bundamba, these beds having been brought dow present position about Walloon and Purga by a folding lower beds along an axis striking north-westerly acro through the town of Ipswich.

III. TRANSPORT FACILITIES.

Most of the coal from the North Ipswich district com Bremer and Brisbane Rivers in punts, the distance to the Brisbane being about 35 miles, and to deep water at Pin

45 miles. The coke is removed by the North Ipswich branch line through Ipswich to Brisbane, a distance of about 26 miles to the wharves.

The Bundamba district is served by several branch lines and short spurs from the main line. Of these the latest one finished goes south from Redbank Station, 15 miles from the wharves, and reaches the furthest point of the field in another seven miles. It loops on at this point with the old Swanbank line, starting south from Bundamba, 20 miles from the wharves, and tapping the western and southern portion of the district. The more remote mines at Walloon and Rosewood are situated near the main line to Toowoomba, distant 30 miles and 36 miles respectively from Brisbane; while that at Purga, on the branch line from Ipswich to Dugandan, is situate about 29 miles from the port.

IV. MAPPING OF THE FIELD.

1. General Map of the Coalfield.

The Ipswich Coalfield was first geologically mapped and reported on by the author in 1899. Map No. 2, accompanying that report, was on a scale of 20 chains to an inch, and embraced all the coal mines then working, except those at Purga and Walloon. In the North Ipswich district the outcrops of six seams (all of which had been worked to some extent) and of their accompanying beds of sandstone and shale were mapped in detail over an area some three miles in length along the outcrops of the seams on the northern side of the Bremer River by about a mile in breadth. In the Bundamba district the outcrops of seven known seams and their accompanying beds were shown as far as they could be traced over an area of about twelve square miles between Bundamba and Six-mile Creeks. These two districts are separated by a large area of basalt country between Bundamba Creek and Ipswich, and by the alluvial deposits along the bends of the Bremer River, and the relations between the two areas are thus obscured. Recent more particular study, however, has furnished a theory of their connection with each other, which shows a great probability of being approximately correct, and which has important economic bearings. This connection is shown on the general map of the field accompanying this report. The map is on a scale of one mile to an inch, and gives a clearer idea of the geological structure of the field and the connection between the different areas than the older map. On it is shown the probable trend of the outcrop of the highest seam of the Bundamba district (the Aberdare Seam) under the basalt and alluvium referred to above. Above this seam in the Bundamba district, and stretching round the southern edge of the basalt towards the south of Ipswich, is a great thickness of sandstones, which have not yet given signs of being coal-bearing, and which I have named the "Bundamba Grits," or unproductive series. The base of this unproductive series crosses the outskirts of the town of I the south of Denmark Hill, the fossiliferous shales and coals (the summit of that hill being apparently on the same horiz Aberdare Seam, while the underlying Four-foot Sandstone a crosses the northern slope of the hill where it is quarried ; points for gravel. The Cooneana Sandstone of the Bundaml immediately underlying the lower seams of that district is a identical with a sandstone which stretches across the wester of Ipswich from the quarries at the end of Harlin road past of the Grammar School, and is found again overlying tl Ipswich seams about Tivoli.

If this theory as to the position of the various beds be (must follow that the coals of the North Ipswich district are o horizon than those at Bundamba, being represented in the members by the coals and shales underlying the Cooneana S which are the lowest beds exposed in the Bundamba distri may, therefore, be expected to be found over a wide area in t of the latter district at no great distance from the surface.

The present mapping thus shows a lower productive serie containing the coal seams of the North Ipswich and B districts, overlain further south by an unproductive series rocks, the highest members of which are not seen. These la bound the extension of the former on the south from G Ipswich, thus limiting the area over which mining on these c be expected to extend in this direction. To the west of Ipsw unproductive beds—and with them, of course, the underly bearing beds—are sharply bent over to the south-west over westerly striking axis of folding, by which a still higher serie bearing beds is brought in. These beds were first worked fc Walloon, and may be known as the "Walloon Beds," or uppe tive series. They are also worked to some small extent at I and Purga, and apparently occupy the whole of the area of south-west of a line drawn from Yahmahnto, on the Fassifer Borallon, on the Brisbane Valley line. They afford few e consisting mainly of soft sandstone and clay shales, whi weathered to a generally level surface. The coals contained are quite distinct in character from those worked in the lc ductive series about Ipswich and Bundamba, having a mucl content of volatile hydrocarbon and a different physical struc

2. Map of the Bundamba District.

In the North Ipswich district there has been little fresh ment of importance since the writer's previous report. The pr for 1904 was about 54,182 tons, as against 46,743 tons duri these figures representing a drop from 16 per cent. of the tot former year to 14 per cent. in the latter year. The number of p mines dropped from eight to five. In the Bundamba district, however, the opening up of a number of new pits to the south and east of the old established mines around Blackstone, Bundamba, and Dinmore led to a request for a more complete map of this district, which would show the relations of the seams opened out in these mines to the earlier worked and better known coals. Accordingly, this district was mapped again on a larger scale (viz., 10 chains to an inch), and the map has been extended to take in the whole of the area over which the productive series of the coal measures occur between Six-mile and Bundamba Creeks, these beds being covered to the east, south, and west by the overlying and unproductive Bundamba Grits.

In this map the positions of the main workings and their general trend is shown by shading. The workings thus shown have no pretensions to accuracy of detail, as it would have involved a much greater expenditure of time than seemed justified by the benefits to be gained to have brought all the workings up to date and accurately plotted them on the map. The detail shown is intended merely to indicate generally what areas have been worked to the greatest extent, and to bring out more clearly the trend of these seams across the field.

The topography of the district has been derived from various sources, and accuracy in detail is not here claimed. It is unfortunate that the Geological Survey has no officer on the staff who could be engaged solely in making topographical maps of important mineral areas, and the Ipswich Coalfield is a mineral area that deserves early attention in this respect. A topographical map of the field, properly contoured, and with surface features accurately delineated, would not only be of the utmost value to the geologist and prospector as an aid in locating and tracing seams, but would also be of service to every mine manager and proprietor interested in the coal-mining industry. The accompanying map gives as much of detail as could be gathered in the time that I found justified in expending on the work. The greater portion of the topography was compiled from maps and original survey plans in the Lands Office, but the Railway Survey Department also kindly lent important aid with details of railway and feature surveys of certain portions.

The detailed mapping of this district has, I think, allowed of a correct representation of the relation between the seams around Dinmore and New Chum with those of the rest of the field. This relation has hitherto been obscure. It will be explained later on in this report. The drawing in of the outcrops of the various seams over many areas as yet untouched should, I think, prove of some considerable assistance in future prospecting along these outcrops. The mapping has also served to show the limits of the area over which the coals of the Bundamba district can be expected to be found at workable depths, this area being limited to the east, south, and west by the depth to which the coals can be worked under the overlying unproductive Bundamba Grits.

V. GENERAL GEOLOGY OF THE TRIAS-JURA SYSTEM OF SOUTHERN QUEENSLAND.

AGE AND EXTENT OF THE BEDS.

The beds of the Ipswich Coalfield have furnished some seventy species of plants belonging to the natural orders Calamariæ, Filiciæ, Cycadaceæ, and Coniferæ, by which they have been determined to be of triasso-jurassic age. They have also furnished one genus each of Crustacea, Insecta, and Lamellibranchiata.

Beds of similar lithological character, and furnishing here and there examples of the same flora, are met with over an area of about 30,000 square miles in the Moreton, Wide Bay, Burnett, and Darling Downs districts and in the southern portion of the Leichhardt district. An extensive area of these rocks stretches as a belt some 40 miles in width in the form of a crescent running from the heads of the Richmond and Clarence Rivers, in New South Wales, for a distance of some 300 miles in a north-westerly direction to the head of the Dawson Valley, in the Leichhardt district. Besides the mines of the Ipswich Coalfield, this belt contains numerous other seams of coal, which have been worked to some extent in the Walloon-Rosewood districts, and in several places on the Darling Downs, west of the Main Dividing Range.

South of the city of Brisbane this extensive belt is connected by a narrow neck of the same rocks with a second long strip which extends for about 300 miles along the coast from a little south of Brisbane to a little north of Bundaberg. The maximum width of this belt is about 40 miles. The coalmines of the Burrum Field lie in this coastal belt of the Trias-Jura. At Point Arkwright this belt is shown on the Geological Map of the colony to be broken by a tongue of older Palæozoic rocks, but in a paper read before the Linnean Society of New South Wales, entitled "The Geology of the Volcanic Area of the East Moreton and Wide Bay Districts," Mr. H. I. Jensen has recently stated that "there is no break between the Ipswich and Burrum Coal Measures, as the Geological Map of Queensland leads one to suppose."

Mr. Jack included all the beds north of Point Arkwright in his "Burrum Formation," the rocks south of that point and in the inland belt of Trias-Jura being included in a later "Ipswich Formation."

The Burrum Formation has as yet furnished only some ten or eleven species of plants, of which four occur in the Ipswich Beds, while all the genera are represented by allied species in the Upper Beds. In addition, two genera of lamellibranchs from the Burrum Beds have not as yet been found in the Ipswich Beds. In view of the distance between the places where these two formations have been mainly studied, and the paucity of the flora as yet found in the Burrum Beds, there does not seem to have been sufficient evidence for a separation of the Trias-Jura into two formations; and, in any case, the evidence for considering the Burrum Beds as belonging to an earlier period of the Trias-Jura is not conclusive. The two formations have long been considered as identical in age by the Geological Survey, and the recent observations of Mr. Jensen lends confirmation to that conclusion.

GENERAL DISPOSITION OF THE TRIAS-JURA BEDS.

The Trias-Jura Beds along the coast between Brisbane and Bundaberg, and the larger inland belt in which the Ipswich and Darling Downs Coalfields lie, were laid down on a floor of highly-folded Palæozoic rocks, which have been intruded by plutonic rocks, mainly of a granitic type. These older rocks have subsequently been exposed over a wide area between the two belts of Trias-Jura by a gentle bending up of the earth's crust since their deposition. This area of bending runs, roughly, in a north-westerly direction from a few miles west of Brisbane. Subsequent denudation of the coastwise fall of the anticline thus formed has denuded off wide areas of Trias-Jura along the upper waters of the Burnett, Mary, and other coastal rivers. Numerous small isolated areas of Trias-Jura Beds are still found scattered along the crest of the broad anticline with varying gentle inclinations from the horizontal. These isolated areas have escaped the general denudation, and still give evidence of the once continuous occurrence of the Trias-Jura over the whole area.

As a consequence of this bending up of the Trias-Jura the beds of the coastal belt have a general east to north-east dip under the sea, while those of the inland belt have a general south-westerly to west-south-westerly dip under the overlying Cretaceous rocks of the Artesian Water System of the interior. The Cretaceous rocks succeed those of the Trias-Jura without any observable break or stratigraphical unconformity, but with a complete change from the terrestrial and estuarine flora of the latter to a fauna of marine mollusca and allied genera. The bending up of the Trias-Jura Beds becomes inappreciable in amount to the south of the Brisbane River, with the effect that these beds can here be traced right across the axis of the fold, thus forming the strip of Trias-Jura country south of Brisbane, which joins up the inland and coastal belts described above.

THE NORTHERN BOUNDARY OF THE IPSWICH COALFIELD.

The coal beds of the Ipswich Field are amongst the lowest of the Trias-Jura system exposed by the gentle bending of the strata above described, and by the denudation to which they have been subjected along the Brisbane and Bremer Valleys. They lie close to the junction with the Palæozoic rocks, along the crest of the broad anticline above described. The junction between the two systems here runs roughly east and west, and has been mapped in detail for some 30 miles along the course of the Brisbane River. Along this junction

a series of coarse conglomerates interbedded with some th
stones, and occasionally with thin layers of coal, has been ex
a puckering up of the Trias-Jura Beds in the bending proce
referred to and by the denudation of the overlying coal-bear
lying further to the south.

These conglomerates dip roughly to the south-east, and
represent the basal beds of the Trias-Jura System. Alo
northern boundary on the Brisbane River they abut against
gular wall of the older Palæozoic rocks, and are no doubt th
of the destruction of an old coast of those rocks by an a
sea or lake, in which the higher coal measure rocks were subs
laid down. In the former report on the Ipswich Coalfield, t
tion along the Brisbane River was assumed to be a faulted on
further consideration I am led to the opinon that it is m
unconformable junction representing an old cliff face of the T
period.

The relations between the two systems have been clearly
by the course of the Brisbane River, which has carved out its
valley along the junction over a distance of some 30 miles.
over which the conglomerates are exposed extends for a dis
about 10 miles along the junction, and is shown on the accom
general map of the coalfield.

THE IPSWICH BEDS.

Overlying the basal conglomerate of the Trias-Jura Syst
covering an area of about 50 square miles to the north and sou
Western railway line, between the towns of Goodna and Ips
the coal measures proper of the North Ipswich and Bundamb
districts. I have restricted the name "Ipswich Beds" to t
of the Trias-Jura System, because it was these beds that w
worked and studied, and because it has become possible b
study to distinguish them from the later coal measures of t
system which have been worked about Walloon.

The Ipswich Beds probably represent a thickness of some
of sandstones and shales, with fourteen or fifteen interbedd
that have been worked at one time or another in the two
abovenamed. These beds have been thrown into long gent
with general maximum inclinations from the horizontal
15°. The area over which they have been exposed lies nearl
crest of the Trias-Jura anticline, and the puckering up of
into the gentle folds just described has apparently been a min
of the general folding about the axis of that anticline. Th
quent planing down of the crests of these folds by surface de
has exposed the outcrops of the seams, which it has thus been
to trace in detail over a great portion of the coalfield.

South of the area of the coalfield the folding across the Trias-Jura anticline appears to decrease in amount, and the Ipswich Beds sink under the next succeeding stage of the Trias-Jura, which I have named the Bundamba Beds.

THE BUNDAMBA BEDS.

The Bundamba Beds succeed the Ipswich Beds conformably, and occupy the greater part of the south-eastern corner of the general map of the coalfield. The have, so far, proved unproductive, except for a small seam of about 1 ft. 6in. near their base, which was formerly worked from the West Moreton shaft, south of Blackstone, and was known as the West Moreton Seam. Their base may conveniently be considered as lying about 70 ft. above the top seam (the Aberdare Seam) of the Ipswich Beds, and forms a generally easily recognised horizon of coarse grits and conglomerate, by means of which it has been possible to draw in the position of the outcrop of that seam throughout the field. The base of the Bundamba Grits, which thus gives a pretty good indication of the limits of the area over which the coals of the Ipswich Beds may be expected to be within workable distances of the surface, has not been traced further east than Goodna. Beyond that town it is overlain by more recent beds, possibly of Cretaceous Age, from which a rich flora of Dicotyledonous plants has been obtained. The Bundamba Beds consist of coarse grits and sandstones with thin interbedded finer strata.

MONOCLINAL FOLDING OF THE IPSWICH AND BUNDAMBA BEDS AND THEIR JUNCTION WITH THE WALLOON BEDS.

West of the town of Ipswich the lower series of the Trias-Jura just described have been sharply bent over an axis striking north-north-west and south-south-east, and disappear to the west under the softer sandstone shales and clays of the Walloon series. The Walloon Beds lie with only slight deviations from the horizontal, and cover a wide area in the Walloon, Rosewood, and Dugandan districts, where they have been worked for coal at several points. The upturned edges of the Bundamba Grits and Ipswich Coal Beds can be followed over a width of about a mile, and have been traced over a length of about five miles. The strike of the upturned edges of the beds is about north-west and the dip about 80° to the south-west.

Owing to the softer character of the strata of the Walloon Beds, and perhaps to their general horizontality, the country over which they lie to the west of Ipswich has been levelled down to a peneplain, through which the Bremer River meanders with a very slight fall in its course. As it crosses the harder sandstones of the Bundamba and

Ipswich Beds, however, its fall becomes much steeper, and is marked by rapids at several points about Ipswich, the country meanwhile becoming more hilly and the valley of the river more pronounced.

The level character of the country of the Walloon Beds, and the absence of any sections showing them in contact with the Bundamba series, prevent any clear exposition of the relation between the two series in the field. The general mapping, however, appears to me to lead to the conclusion that the Walloon Beds have been faulted down against the Bundamba Beds along a line running parallel with the axis of the sharp folding to which the latter have been subjected. Traced to the north, this line of junction, and probably of faulting, is cut off by the older Palæozoic rocks, but is apparently continued on as a line of faulted junction between the Walloon Beds and the Palæozoic rocks, with which they come here into direct contact. This probable continuation of the faulting is shown more clearly on Map No. accompanying the first report on the Ipswich Coalfield.* The accompanying plate shows the relation between the Walloon and lower beds south of Ipswich.

There is also the possible explanation that this north-west striking line of junction first between the Walloon Beds and the Bundamba Beds, and then between the Walloon Beds and the older rocks, is an ordinary unconformable junction, representing a stratigraphical break within the Trias-Jura. In any case, there seems no doubt that the Walloon Beds belong to a much higher horizon of that series than the Ipswich and Bundamba Beds.

THE WALLOON BEDS.

The Walloon Beds have not as yet been studied in any detail. Indeed, the rarity of outcrops of rock over the level area to the west of Ipswich, and the absence of much mining or quarrying, precludes any very detailed study of the formation. What little we know of them, however, shows that they possess features which differentiate them from the coal-bearing beds of the Ipswich Field. The coals hitherto found show a characteristic choncoidal fracture in the hand specimen, burns readily with a long, luminous flame, and give off a much larger proportion of volatile hydrocarbons when heated in a closed vessel than do the brittle bituminous coals of the Ipswich Beds. It does not, however, seem possible to draw any distinction between the formations from palæontological evidence, most of the fossils as yet found in the Walloon Beds occurring also in the Ipswich Beds.

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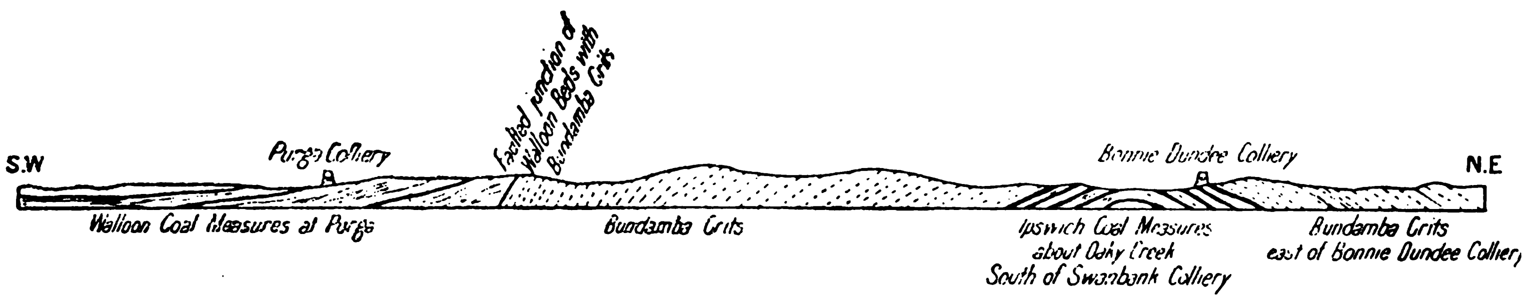
* Geological Survey Publication, No. 147.


S.W
N.E
Purga Colliery
Faulted junction of Walloon Beds with Bundamba Grits
Bonnie Dundee Colliery
Walloon Coal Measures at Purga
Bundamba Grits
Ipswich Coal Measures about Oaky Creek South of Swanbank Colliery
Bundamba Grits east of Bonnie Dundee Colliery

Section across Trias Jura Beds of Ipswich Coal Fields between Purga and Bonnie Dundee Collieries showing junction of Walloon Coal Measures with lower Series

Scale 80 Chains to an Inch

40 80

POSSIBLE DIVISION OF THE TRIAS-JURA SYSTEM INTO TWO STAGES.

The Walloon Beds thus, no doubt, lie on a considerably higher horizon of the Trias-Jura System than the beds about Ipswich. These latter have not been mapped in detail east of Goodna, but there is not ranting evidence that they are continuous to the east with the sand-tone and associated coals which are now being prospected about undah, continuing thence along the coastal lands between Brisbane nd Bundaberg, probably including all these beds, and among them le Burrum Formation.

All the inland belt of Trias-Jura rocks west of Ipswich, on the her hand, is characterised by coals similar in character to those und about Walloon, Rosewood, and Purga, and it seems extremely kely, notwithstanding the as yet negative results of the palæontologi-l evidence, that future more detailed study will impose upon us the cessity of considering the Trias-Jura system as divisible into two ages, an earlier represented by the beds of the Ipswich and Burrum oalfields, and a later represented by the coalfields of Walloon, urga, and the Darling Downs.

THE REDBANK PLAINS BEDS.

About the farming district of Redbank Plains there occurs an rea of fissile shales which are seen to lie with a more or less distinct nconformity on the coarse grits and sandstones of the Bundamba eds. They can be traced all round the southern margin of the beds f volcanic rocks, which give the chocolate soil of the plains, and have een sunk on in various shafts for wells along Six-mile Creek and on le farms in the south-eastern corner of this district. They have fforded some fragmentary fish remains and remains of Dicotyledonous lants, which latter circumstance points to a probable identity with he supposed Cretaceous beds found about Darra and Wolston. They ppear to lie practically horizontally. Near Jones's Bee Farm they re accompanied by soft felspathic sandstones. A few yards further ast the underlying grits of the Bundamba Beds are found lying with arying angles of dip of up to 30° from the horizontal, and give vidence of a more or less distinct unconformity with the overlying hales. The area covered by these presumably Cretaceous beds is hown in green on the map.

BASALTIC AND FELSITIC LAVA FLOWS.

Several large areas of these rocks are shown on the general map, s well as a few isolated patches, which seem to indicate a once almost ntinuous extension over the whole of this area. From the lighter lour of the soil about Redbank Plains and the more acid character the weathered specimens of rock that were observed, it seems pro-ble that the lavas in this area were more of the nature of andesite trachyte, and they have consequently been mapped as felsitic in racter as distinguished from the more basic basalts of the other tion.

Chapter II.—The Bundamba Dist

I.—DETAILED GEOLOGY.

1. General Disposition of the Beds.

The productive coal measures in the Bundamba dist
of alternating conglomerates, grits, sandstones, and shal
least seven well-recognised beds of coal, six of which have b
at one time or another. They are exposed to a depth of a
feet from their uppermost beds, the lower beds of the serie
exposed. They are overlain round the south-east, south,
west of the area shown on the map by the overlying u
series of grits and sandstones which I have called the Bunda
and have been brought up from beneath these beds by a
of the strata over an axis running in a north and sout
across the centre of the field. This bending of the strat
irregular anticlinal ridge, with an average maximum dip
side of about 14° from the horizontal. The beds are th
along their outcrops in descending order along the western
field, as it is traversed from west to east, and the same bed
exposed in ascending order as the eastern side is crossed. T
up has been most severe about the centre of the northern
field, so that the lowest beds are exposed here in the Coone
They outcrop over an oval-shaped area, with its longer
and south, and with the succeeding higher beds running i
down either side of the field. South of the area at present
bending up of the beds decreases rapidly, and the outcrops o
coal beds can be traced round from one side of the field to

The north-eastern corner of the district about Dinmor
Chum is cut off from the rest of the field by a line of faultin
and Rhondda Faults on the map), which breaks the regula
line of outcrop in this direction. The beds are thrown d
north-east by this faulting, so that they lie with only gentle
over an area of about a square mile and a-half round Di
New Chum, between these faults and the Ebbw Vale F
throws up the beds again to the north-east. The New Chu
been worked by several vertical shafts between these two
has been one of the most important producers of steam
district.

Five years ago this seam was the most productive of
district, being pressed closely by the Aberdare Seam, work
time solely along the western dip of the measures in the
hood of Blackstone. During the last five years numerou
have been opened along the southern extension of the Aber
beyond Blackstone, and also along the eastern fall of the be
Six-mile Creek; so that the Aberdare Seam is now by fa
productive of any in the Ipswich district.

Besides this new work on the Aberdare Seam, several new collieries have also been lately opened up, and prospecting work has been done on some of the lower seams in these directions—in one or two cases with considerable success.

The opening up of these collieries has thus shown the importance of these seams to the district, and has allowed of the mapping of their continuation to the south and east of the older established collieries with a much greater degree of accuracy than was possible five years ago. This has permitted of the identification and correlation of the seams in a much more satisfactory manner. There is still doubt as to the exact position in the series of some of the seams, but it is hoped that the new map will assist in the elucidation of these points in the near future.

The various horizons by which these seams can be traced will now be considered in detail in ascending order.

2. THE COONEANA SANDSTONE.

The lowest persistent bed that is exposed over any considerable area is a sandstone, which is shown on the map to outcrop over a roughly oval hollow area in the northern portion of the map on the Cooneana Estate, and is marked as the Cooneana Sandstone. This sandstone dips out in all directions from the centre, and must be about 100 feet in thickness. Below it is an area of shales, which show few exposures, but give signs of being coal-bearing. From reasons advanced later on, it seems probable that the Cooneana Sandstone is on about the same horizon as the thick bed of sandstone found overlying the Garden and Tantivy seams (the highest seams) in the North Ipswich district, in which case the underlying shales show every likelihood of containing seams of economical value. The Cooneana Sandstone is not exposed elsewhere on the field; but, in a bore put down from the bottom of the New Chum No. 3 shaft, Mr. Jeffries, the manager, tells me that, after passing through shales containing two lower seams, a considerable thickness of soft felspathic sandstone was passed through from 162 feet below the floor of the New Chum Seam. This sandstone I take to be the Cooneana Sandstone, lying, as it thus does, about 400 feet below the next succeeding and easily traceable bed of sandstone immediately above the Four-foot Seam, which I have called the Four-foot Sandstone.

3. THE BUNDAMBA SHALES AND LOWER COALS.

Between these two easily recognisable beds of sandstone is a series of about 400 feet of ferruginous shales, carrying the five lower seams of coal of this district, and several thin bands of soft flagstones. These shales weather to a rusty red soil, which generally gives a sufficient indication of the character of the rock being passed over. The coal seams, in ascending order, have been named Doby's, Rob Roy, Striped Bacon, Bergin's, and the Four-foot.

These seams were first worked near the township of Bun in the north-western corner of the district; and the work e: along the outcrops of the seams in a southerly direction up the side of Bundamba Creek. I have consequently called the beds i these seams lie the Bundamba Shales. The workings along Bu Creek have, however, long been abandoned. In the Dinmore the important New Chum Seam is one of this series, and h worked continuously for a number of years. Recently several o have been made, and two collieries started on seams belonging series on the southern and eastern extension of this outcrop Blackstone and Cooneana. Of these, the Rhondda Colliery, eastern fall of the beds towards Six-mile Creek, has been th successful; while in the new pit of the Aberdare Company, on th foot seam, and in Wall's pit, probably on the continuation of I Seam, a considerable amount of prospecting has been done. the Dinmore district and the Rhondda Colliery, however, bu coal is as yet being turned out from these seams.

On the southern portion of the Cooneana property the damba shales and their accompanying coals dip under the F sandstone which immediately overlies them. They reappea further south in the drainage basin of Oakey Creek, and are fou a considerable area where the coals have been exposed in a nu prospecting openings. Up to the present, however, the Sw Colliery Company is the only one which has worked them succ its operations on the two uppermost coals having been carried tinuously ever since the discovery of coal on the northern l Oakey Creek, about 1890.

4. THE FOUR-FOOT SANDSTONE.

The Four-foot sandstone, which is found overlying the Bu shales immediately above the Four-foot Seam, forms a readily t horizon, which has been mapped with a considerable degree of a over the greater portion of the district. About Bundamba and stone it is some 300 feet in thickness, but further south it dec thickness, till, between the Mafeking and Denham pits, it ca much more than 150 feet. Its outcrop can be traced round f western side of the field to the Rhondda Colliery on the east, wh displaced by the large fault (the Rhondda Fault) lying to the no of that colliery. It is again found in the Whitwood No. 3 shaft the road in the gullies to the south of that colliery. About th of the area mapped, south of the Cooneana Estate, this sandston the lower Bundamba shales and lower coals over a considerable the east of the Bogside and Mafeking mines, stretching across t of the anticline from west to east. It has been brought down a slight troughing of the beds under an east and west axis of be

On the hill above the Swanbank Colliery this sandstone is inter- lated with beds of coarse, pebbly conglomerate, which was formerly pposed by the writer to be a continuation of that overlying the Aber- are Seam about Blackstone, but which the detailed mapping, rendered ssible by the opening of the collieries about Box Flat, and the pros- ecting work incidental to this work, has shown to be bent much rther to the east over a north-westerly striking axis, passing through e Denham Colliery and the north-western levels from the Swanbank ine. The conglomerate can be traced across to the south of Oakey reek, and the sandstone still further followed in a sweeping circle und the southern portion of the map to where the underlying Four- ot Seam has been opened by several shallow shafts near the Bonnie undee railway line.

The Four-foot sandstone, with its accompanying pebbly con- omerate overlying the Swanbank Seams north of Oakey Creek, can traced south across the creek, where the Swanbank No. 1 Seam was ain opened out by two inclined slopes on portion 5, but with no very omising indications.

North-west from Swanbank the sandstone can be traced through rtions 130, 134, and 135 to 147, on the northern end of which a aft passed through the lower portion of the sandstone and exposed e Four-foot Seam. At this point the continuity of the beds seems be broken by a fault, as a second shaft, a little further south, has t met either the sandstone or the coal. The sandstone is shifted rther east, and its probable continuation from here round to portion is only mapped in from its known relation to the overlying beds ich have been followed round further south.

5. The Aberdare Shales and Overlying Bundamba Grits.

Above the Four-foot sandstone is another bed of shales about 0 feet in thickness, and containing two persistent seams of coal—one ar the bottom, known as the Bluff seam, and the other near the top, own as the Aberdare Seam. The position of these shales can be aced most readily over the whole district by means of the overlying its and sandstones, which form conspicuous outcrops marked by many lges and abrupt escarpments. The Aberdare Seam, the most valuable the district, was first worked under the conspicuous hill to the south Blackstone, formed by the outcrop of these grits and coarser beds of nglomerate. It was the tracing of this series of coarse and hard beds the south and east of Blackstone, and the consequent mapping of the derlying coal, which encouraged the opening up of the four new pits ng the eastern margin of Box Flat, and the still more recently opened ines along the eastern fall of the beds near Six-mile Creek.

II.—THE SEAMS.

1. THE ABERDARE SEAM.

This seam is at present the most productive and most sought after seam in the district. Its yield increased from 31 per cent. of the total output of the district in 1899 to 55 per cent. in 1904, the output of the New Chum Seam, the second most productive, having dropped in the same time from 38 per cent. to 21·5 per cent. of the total. In 1898 the Aberdare Seam was worked in only two collieries—the Aberdare and West Moreton Collieries, situated on the western dip of the beds near Blackstone. Since then four new collieries have been opened up along the southern extension of the outcrop past Box Flat, the southernmost working being about 2¼ miles from the northernmost levels of the Aberdare Colliery. The shaded portions on the map show the positions of these workings, and roughly the extent to which the seam has been worked.

The Aberdare Seam has a good reputation as a steam coal, and has given high evaporative results wherever it has been tried. It produces very little clinker, and a relatively small proportion of ash.

Fig. 2 is a section of the seam, taken by myself, in Walker's Fairbank Colliery. This section shows about 11 feet of coal in about 14 feet of coal and bands, and is fairly representative of the character of the seam about Blackstone. As it is followed to the south, the lower section of 4 feet becomes thinner and of poorer quality, while in the Aberdare Mine, to the north, this section was worked 5 feet in height, over a large area. The seam is worked in two sections. In some cases a top section, down to the 68½-inch mark on the diagram, is taken down first, the bands of stone being picked out before filling. From the 68½-inch mark to the 96½-inch mark is then left as a roof above lower rooms, which are worked immediately underneath on the lower section from the 96½-inch mark to the bottom. In other cases, where the section below the stone, called the "badger" (shown on the figure), is poor, the first section is taken down to the 88½-inch mark in the figure. The 8-inch band of stone is then stripped by yardage, and the underlying 18½ inches of coal lifted, the coal below the "badger" not being worked.

COLLIERIES ABOUT BLACKSTONE ON THE ABERDARE SEAM.

Aberdare, West Moreton, and Borehole Collieries.—The underground workings on the map show the extent to which this seam has been worked. The Aberdare Colliery was the first opened out on the seam, being started by Mr. Lewis Thomas, of Blackstone, on the shallow and easily-mined coal lying under Blackstone Hill. The contour of the ground throws the main outcrop back to the east of the hill, at the same time exposing the seam again as an oval-shaped line on the map on the western fall of the hill. From this outcrop drives ere put in to the rise of the coal and on this level, and the coal run ut at a trifling expense on to a branch railway line coming up the ully that exposes the outcrop.

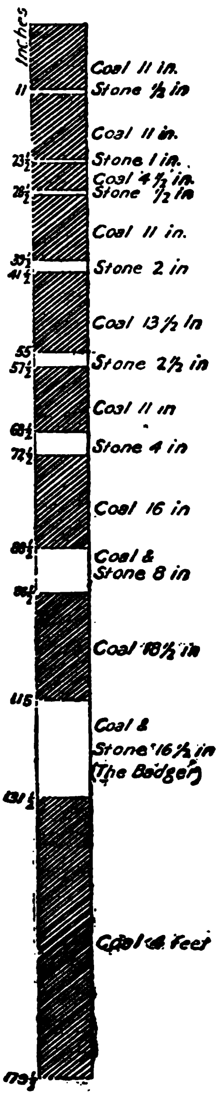


Fig. 2

SECTION OF ABERDARE SEAM
IN WALKER'S FAIRBANK
COLLIERY, BOX FLAT.

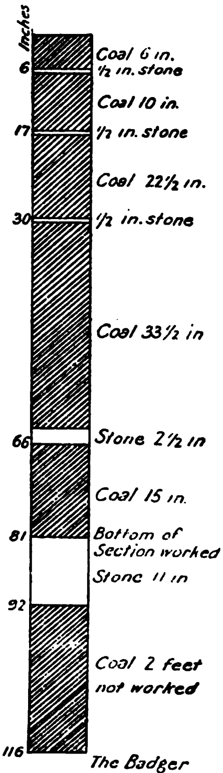


Fig. 3

SECTION OF ABERDARE SEAM
IN NEW WEST MORETON
COLLIERY.

The Aberdare Colliery still takes the lead in output of any colliery the State, with a yearly production of about 60,000 tons. The orkings now extend some 50 chains to the dip of the outcrop, and

20 chains from the dip of the No. 3 (or Coolgardie) shaft, from which the coal is now all mined. The No. 3 shaft is 523 feet deep, and the workings have been extended some 1,800 feet to the north. The grade is almost due west, at an angle of about 14 degrees, or 1 in 4. This has brought the bottom of the dip to a vertical depth of nearly 900 feet below the level of the shaft head, or 1,000 feet below the level of the ground above. Trouble with water has prevented further sinking of the dip. Most of the coal is being won from the levels going north from the dip from the No. 3 shaft. As they go north these levels bend round to the west, the dip of the coal swinging round till, under Silkstone, it is about south-south-west.

The importance of this fact is that the strike of the coal, which is obscured north of the village of Blackstone by the alluvium of Bundamba Creek, is thus proved to swing round under the basalt capping the coal measures here towards Booval Station, thus bringing the coal to within shallow depths along the Brisbane road, in close proximity to the railway line. The strike of the coal beds further west is shown to still curve round under the basalt, for, at the town of Ipswich, the strike is almost south-west, and the dip south-east towards Blackstone. Accordingly, the Aberdare Seam, which dips west under the basalt area in the Coolgardie Mine, must necessarily flatten as it is traced further to the dip, and rise again on the western side of the basalt under the town of Ipswich. The greatest depth in a line due west of the Coolgardie Mine cannot thus be much over 2,000 feet, and there must consequently be a considerable area of country within easy reach of the main line at Booval, under which it is probable that the Aberdare Seam exists in good quality, and nowhere at a greater depth than 2,000 feet.

The Aberdare Seam has also been worked over a considerable area to the south of Blackstone, from the Aberdare No. 2 and West Moreton shafts. The workings from the former shaft extended to a distance of about ½ mile to the east of the shaft, the level course here swinging round to almost due east. The swinging round of the dip is clearly shown by the tracing of the underground levels on Map 2. The workings were blocked by a fault, and, owing to fires in the gob, they had to be abandoned. The West Moreton workings to the south also met with troubled ground, the coal being apparently thrown up to the south-west by a fault striking in a south-easterly direction across the drive to the south. An attempt was made to find the coal on the further side of this fault by sinking a second shaft (No. 2 shaft), the position of which is shown on the plan. Unfortunately for the promoters of this scheme, the position chosen lay in the centre of an altered dyke of igneous rock which here cuts through the coal; and, after 85 feet of sinking, the work was abandoned. These dykes are common to the district, and do not seriously affect the quality or position of the coals; so that, had a position been chosen a little to the east or west of the dyke, in all probability the seam would have been struck at no great depth, and a large area of land have thus been opened up successfully. This failure led to the seeking of coal lands elsewhere, and ultimately to the tracing of the seam round the eastern side of Box Flat, as shown hereafter.

North of the village of Blackstone, the Borehole Colliery also worked the Aberdare Seam, by means of a shallow shaft and stope. This colliery has been opened up again lately, having been idle for many years. It is not yet on the list of steady producers.

COLLIERIES ABOUT BOX FLAT ON THE ABERDARE SEAM.

Fairbank, Box Flat, Bog Side, and Mafeking Pits.—Since the date of the writer's last report (1899) these four collieries have been successfully opened up on the southern extension of the Aberdare Seam across the level country of Box Flat. They extend over a length of about 1 mile along the outcrop. Being situated close to an already existing railway line, and starting on the outcrop of a thick seam of coal of good quality, they have been able to mine large quantities at very cheap rates, and have thus been able to compete successfully against the older-established mines with their handicaps of long underground haulages. Their success has demonstrated the continuation of the Aberdare Seam, with little deterioration of quality or thickness, over a large area which was virgin ground at the time of the writer's previous report on the field. In that report the probability of the extension of the Aberdare Seam under the whole of the area embraced by Box Flat and the ridges lying immediately to the north-east was pointed out, and the probable position of the outcrop was drawn in on the accompanying map. The results obtained by these four collieries during late years is a striking example of the advantage of having coal at shallow depths. During last year the four pits, out of a total of twenty producers, secured over 37 per cent. of the trade.

As yet little more than the coal within a few chains from the outcrop has been extracted, though, owing to the steep dip of the beds, the coal is rapidly being carried to depths which are, in some instances, making trouble for the light hauling appliances installed for shallow working along the outcrop. The area of ground underlain by the Aberdare Seam to the east of Bundamba Creek, in this locality, is bounded on the north by the old Aberdare workings, and on the south by a bending-up of the beds, which rapidly throws the outcrop of the seam out to the west between the Mafeking and Swanbank Mines. The Box Flat Colliery, which includes the greater portion of the deeper ground over this area, has commenced deeper mining by sinking a vertical shaft, 405 feet in depth, about 16 chains from the outcrop, and has installed a winding-plant capable of dealing with a considerable output. This colliery also has lately installed the first coal-cutting machine employed on this field.

The levels from the bottom of the shaft show a flatteni
going north, and a steepening dip going south. The flattening
dip going north should bring the coal to shallow depths over
area between the Box Flat workings and the Aberdare No. 2 w
and over the south-eastern corner of portion 286. The am
ground still untouched here and at a depth of less than 400 feet
not be less than 100 acres. The probability is that the Aberdar
is nowhere more than 700 feet in depth to the east of the Sw
Railway Line, which should give about Box Flat an area of c
untouched, and at a less depth than 700 feet, of over 260 acres

CONTINUATION OF THE ABERDARE SEAM SOUTH OF BOX FLA

The Mafeking pit of the Swanbank Collieries Company,
the southern end of Box Flat, is the furthest southern working
Aberdare Seam. The mine consists of a slope driven nearly d
on the dip of the seam for a distance of about 350 yards. T
going south met a fault at about 200 yards south of the m
which cuts off the coal and has thrown it up a vertical distance
100 feet, bringing the next lower seam—the Bluff Seam—int
position with the Aberdare in one of the levels. South of th
the coal has been lately picked up by Mr. Harris, the man
prospecting workings on the northern slope of Mafeking Hill,
outcrop has been traced over the brow of the hill on to its east
southern slopes. In this locality the strike of the coal h
changed, as mentioned above, by a bending up of the strata
north-westerly running axis of folding, so that the dip has been
to a direction a few degrees west of north, and the continuatio
line of outcrop is thrown round into a westerly direction. The lin
crop is further deflected, as it is followed down the slope of the
the lowering of the ground into a direction north of west. Bey
point the continuation of the line of outcrop is uncertain. The
back of the beds, however, over the north-westerly axis above
to, which is evidenced by the workings on the lower seams
Denham and Swanbank Collieries, should bring the coal ba
about the position indicated by the broken line on the map. T
of ground is covered by the alluvium of Bundamba Creek, unde
the outcrops of the seam and that of the overlying beds of sa
are hidden, so that its position cannot be indicated with any d
certainty.

The overlying beds of grit and sandstones usually foun
this seam are again observed along the eastern side of Ivory's
and can be traced by numerous outcrops in a half circle ro
extreme south of the map.

On the heads of Oakey Creek Mr. W. Binnie recently o
shaft, which I have no doubt is on the same seam. The seam

lain by a thick mass of sandstone, which is passed over in a traverse further up the creek, and can without doubt be traced continuously to the known outcrops of the seam both to the north and west.

Mr. Binnie informs me that he found no workable section of coal in this seam, and this fact is decidedly disappointing, if the shaft proves, as I have no doubt it will, to be on the continuation of the Aberdare Seam. It shows that in the locality of this shaft, at any rate, this excellent seam has deteriorated so much in quality and thickness as to be unworkable.

NEW COLLIERIES ON THE EASTERN FALL OF THE ABERDARE SEAM.

The Bonnie Dundee, New West Moreton, and Fernie Creek Mines.—The grits and conglomerate overlying the Aberdare Seam are again found along the western side of Six-mile Creek, from the heads of Oakey Creek to the mouth of Fernie Creek, forming a series of rough stony ridges. The Aberdare Seam has been opened up by three new collieries along the western slope of these ridges. The Bonnie Dundee Colliery lies on one of the heads of Oakey Creek, and the New West Moreton and Fernie Creek Collieries near the heads of Fernie Creek. These mines are served by the newly-opened continuation of the old Swanbank Railway Line in the case of the Bonnie Dundee, and by a branch line from the Bundamba loop-line in the case of the other two mines.

In the *Bonnie Dundee Mine*, the thickness of workable coal has decreased considerably from that in the mines on the western fall of the beds, but the seam has not been sufficiently opened up to allow of a proper estimate of its value being formed. The height of the coal being worked varies from 4 feet 8 inches to 5 feet, with two small bands 6 inches from the bottom. From the top of the seam to the bottom of the overlying sandstone are about 8 feet of unworkable coal and stone bands. This seems to indicate that the Bonnie Dundee Seam represents the upper portion of the Aberdare Seam, the lower portion being absent.

The overlying sandstones and grits above the Aberdare Seam can be traced in a northerly direction from the Bonnie Dundee Mine to the *New West Moreton* Colliery, where the seam has been opened out by two slopes on the dip of the seam and a drive along the course of the seam under Black's Hill. Fig. 3 is a section of the seam measured in the face of the rooms driven to the rise of this level.

This section corresponds with that of the Abedare Seam above the "badger" stone in the Bog Side and Fairbank Collieries on the western side of the field, except that the bands of stone are thinner, and the total thickness about 6 inches less. The 2 feet of coal at the of the section is not worked, and the coal below the "badger" exposed, being on this side of the field too rough to work.

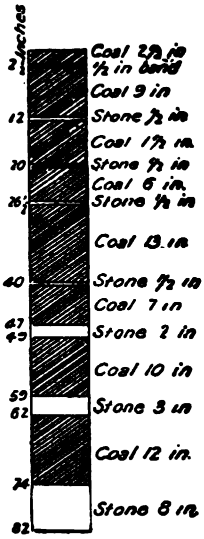


Fig 4

SECTION OF ABERDARE SEAM IN FERNIE CREEK COLLIERY.

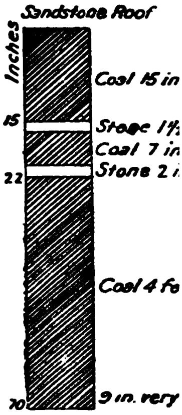


Fig. 5

SECTION OF FOUR-FOOT IN SLOPE OPENING WALKER'S FAIRBAN LIERY.

In the No. 2 slope the whole section of the seam has been e and it shows the section of the coal below the "badger" to b 2 feet 2 inches in thickness, whereas on the western side abo Flat this section of coal runs from 3 feet to 4 feet, and in the A Colliery was worked over large areas to a thickness of 5 feet.

The *Fernie Creek Colliery* has recently been opened on th dare Seam, about 20 chains north of the New West Moreton Mi is fed by a branch line from the railway to that mine. Th outcropped on the western fall of a steep spur, formed by the ov grits and conglomerate, and has been opened by a slope driven due east along the dip of the seam, which is here about 14 Fig. 4 is a section of the coal worked, and evidently represe top section of the Aberdare Seam. The bottom section is sai wanting entirely.

CONTINUATION OF THE ABERDARE SEAM NORTHERLY FROM FERNIE CREEK MINE.

The sandstones and grits overlying the Aberdare Seam at Creek can be traced across the eastern part of portions 286 and the Redbank Plains road to the north-western corner of port At this point a vertical shaft has been sunk under the sandst depth of about 200 feet, but no workable section ot coal was found. Apparently the Aberdare Seam has deteriorated in this direction into nothing but coaly shales. Whether it makes again into good coal east of Six-Mile Creek is still unproved. Geological considerations point to the inference that it is represented further east by the uppermost seam worked under the sandstones of Goodna and Redbank; and if this is the case it does not return to anything like the same quality and thickness possessed by it in the Bundamba district.

2. THE BLUFF SEAM.

This seam has not yet afforded a workable section of coal in any portion of the field, though it has been exposed by prospecting shafts and drives at numerous points over the Bundamba district. It has been possible, by means of these prospecting workings, to map the outcrop of the seam over the greater part of this district. A recent measurement (made by Mr. Harris, manager of the Swanbank Collieries) of the seam as disclosed by a shaft sunk near the Mafeking Pit, shows about 20 feet of bands of stone and coal, the thickest clean band of coal being about 2 feet 1 inch of inferior quality, and no workable section being present. The seam apparently maintains this character over the greater portion of the district.

3. THE FOUR-FOOT SEAM.

This seam can generally be easily identified over the greater portion of the district from the fact that it lies immediately under the first thick bed of sandstone under the Aberdare seam. It generally shows about 4 feet of clean coal at the bottom, with two bands of white stone (divided by a thin band of coal, making about 7 inches in thickness) above, and separating it from another 15 inches of top coal. Between this top coal and the overlying sandstone there is often a foot or so of shale, but in many places the top coal is immediately overlain by the sandstone.

The seam was originally worked on the eastern bank of Bundamba Creek, between Bundamba and Blackstone, in the old Rosehill, Borehole, and Braeside Collieries, in workings long since abandoned. It has recently been opened up by the Aberdare Company immediately to the south of Blackstone by a slope on the dip, about 100 yards in length. The seam here shows about 9 inches of good coal at the bottom, and then about 1 foot 6 inches of rather rough coal, which is difficult to separate in working, and causes a good deal of trouble. The seam can be traced to the south by the overlying sandstone, past a slope put in by Walker Bros. on portion 295, and another put in by Messrs. Auld and Co., on the north-western corner of portion 286, to the ridge crossed by the loop-line between Wall's Mine and New West Moreton branch line. The coal was opened out on the top of the ridge, and again immediately east of the branch line. None of these positions have, however, been developed for producing coal. The section of the seam shown in Fig. 5, and given me by Messrs. Walker Bros., from the opening on their ground, is fairly representative of its character.

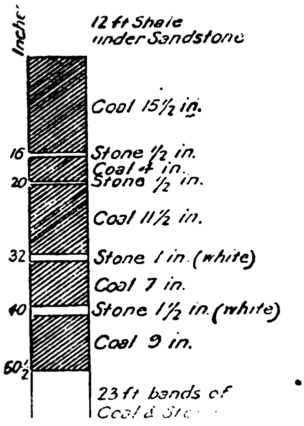


Fig. 6

SECTION OF BERGIN'S SEAM IN SHAFT SUNK BY WALKER BROTHERS ON PORTION 295.

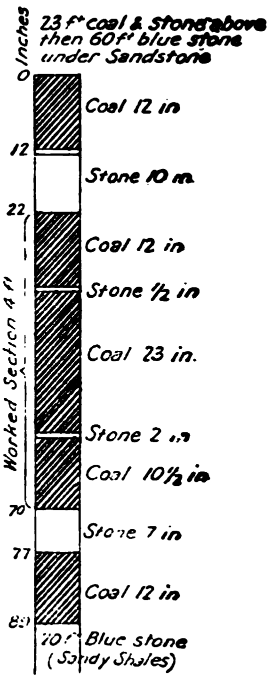


Fig 7

SECTION OF RHONDDA SEAM IN RHONDDA COLLIERY.

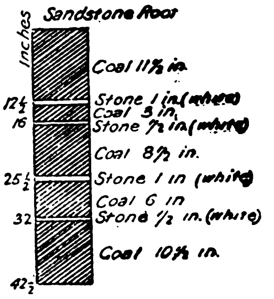


Fig 8

SECTION OF SWANBANK NO. 1 SEAM IN SWANBANK COLLIERY, AS GIVEN BY THE LATE MANAGER (MR. WOOLLEY).

CONTINUATION OF THE FOUR-FOOT SEAM NORTH OF FERNIE CREEK.

The thick bed of sandstone overlying the Four-foot Seam can be traced across the Redbank Plains road, through portions 281 and 283 to the Rhondda Colliery, where the underlying coal has been exposed by three prospecting holes. In the north-eastern corner of portion 273 a fault has been disclosed by prospecting operations in a gully. This fault apparently cuts off the coal to the north-east, throwing it down in that direction, as shown on the map. This fault can be traced by exposures in the gullies through portions 275, 270, 271, and 267, where it joins Gilliver's cutting fault coming through the Whitwood workings. In these portions the sandstone is brought down to the north-east by the fault, and it has been pierced by the Whitwood No. 3 shaft on portion 267 for a depth of 30 feet. Below this depth the shaft passed through coaly shales, which are apparently all the traces left of the Four-foot Seam in this direction.

SEAMS BELOW THE FOUR-FOOT SEAM.

The well-defined belt of shales and coal, which I have called the Bundamba Shales, contain, besides the Four-foot Seam at their top, four other seams, all of which were worked to some extent along the western fall of the bed between Bundamba and Blackstone. These workings have all been abandoned for some years. Lately, two new collieries have been opened up on coals occurring in these beds on their eastern fall towards Six-mile Creek.

4. Bergin's Seam.

This seam was first worked by Bergin on portion 161, east of Bundamba Creek, and subsequently by Lindsay Bros., on portion 159. It was also, I believe, worked on portions 163 and 164. These working have long since been abandoned. Walker Bros. have sunk a shaft on the same seam, on portion 295, in which I measured the section shown in Fig. 6. Below the bottom layer of coal are, according to Mr. Walker, senior, another 23 feet of coal and stone bands.

A seam of coal has recently been opened up in Wall's Mine, which I estimate to be about 70 feet below the Four-foot Sandstone, and which, consequently, corresponds in position to Bergin's Seam. At the top is about 4 feet 6 inches of coal, with bands of stone, which apparently corresponds with the seam at the top of Walker's shaft. Below this are 26 feet of coal and stone, which corresponds with that underneath the coal in Walker's shaft. At the bottom is 11 inches of coal, separated by 5 inches of thin shale from another 2 feet of coal. This latter section forms the main section of coal worked in Wall's Mine. Below this seam is about 3 feet 6 inches of blue shale, and then 3 feet 5 inches of coal, with three bands of stone, which forms the lower seam of Wall's workings. The continuation of this seam round to the north-east is shown on the map, and if it keeps at the same distance below the Four-foot Seam, its outcrop should pass a few yards east of the Rhondda shaft on portion 276.

5. The Striped Bacon and Rhondda Seams.

The Striped Bacon Seam was also worked by Lindsay Bros. on portions 245 and 159, near Bundamba, and was also opened up further south on portion 161, and in the Borehole property on portion 173; but these workings have long since been abandoned. From the position of the Rhondda Seam, below the Four-foot Sandstone in the

Rhondda Colliery, I judge the seam worked there to be the though the matter can hardly be considered quite certain.

Fig. 7 is a section of the Rhondda Seam. In this case 23 1 coal and stone bands, under a thin sandstone, were passed th before reaching a workable section near the bottom. The coal good quality, and the colliery has advanced rapidly into the front as a producer. As shown later, this seam is probably identical the New Chum Seam, which has been proved of such great val the Dinmore district, and has proved that the latter seam contin this direction in good quality, thus opening up possibilities of a area of ground carrying this seam to the south of the Dinmore The Rhondda Colliery is served by a branch line from the Bund loop.

6. The Swanbank Seams.

THE NO. 1 SEAM.

The Four-foot sandstone overlying the Four-foot Seam, wh was opened out by Walker Bros. and Auld and Co. on portion and 286 respectively, can be traced round to the east of the Mal Mine, as far as the south-eastern corner of portion 19. It is her up over the same north-westerly running anticlinal axis as the above it. This gives it a south-westerly strike across the head gullies on the northern end of portion 12, and brings it on to p 13, where it changes to a coarse pebbly conglomerate, forming a escarpment along the eastern boundary of that portion. The bank Seams crop out under this escarpment, the No. 1 seam Swanbank Mine lying immediately below the conglomerate b therefore judge this seam to be the continuation of the Four-foot

Fig. 8 is a section of the seam as it was worked in the Swa Colliery. In this locality the Four-foot Seam appears to decreased considerably in thickness, showing only 42 inches in of 70 inches of stone and coal. The top coal has decreased from 11 inches, but the two white stone bands, separated by a band o are still present. The bottom coal has decreased to 26½ inche shows two distinct bands of stone about the middle. In spite of differences, however, the fact that the seam lies immediately u sandstone roof, which can be traced right round from the slope Aberdare Company on the Four-foot Seam past Walker's slope o to the Swanbank Mine, leaves little doubt in my mind that the Swanbank Seam is a continuation of the Four-foot Seam. The has been very little worked in the Swanbank Colliery.

THE SWANBANK NO. 2 SEAM.

This seam lies about 67 feet below the No. 1 Seam in the bank Colliery, and thus corresponds pretty well in position wit known as Bergin's Seam about Blackstone. The seam here is terised by about 4 feet 6 inches of coal under a shale roof, separated from a lower section, running from 2 feet 6 inches to 3 feet 3 inches in thickness by 1 foot to 18 inches of shale. Below this again are bands of shale and coal, which, however, have not as yet afforded workable coal. This seam has been worked over a considerable area in the Swanbank Mine, on the south-western dip of the beds north of Oakey Creek. These workings have been abandoned, but the seam has again been opened out under the west of Swanbank Hill by a drive in through the overlying conglomerate to meet the seam, and a slope on the seam towards the north east. This is the Denham Colliery. The slope at first went about half-course, the dip being nearly due west. As it went further down, however, the dip swung round till, at the bottom, where the slope has been turned almost due north, it is following down the dip of the seam. This shows that the strike of the Swanbank seams is here almost east and west, and must necessarily bring their outcrops considerably to the east of Mafeking Hill. The Denham slope, in fact, crosses over the crest of the area of folding shown on the plan, and at once gives an insight into the relations between these seams and that worked in the Mafeking Tunnel.

7. Perkins' Seam.

This seam has been exposed by a cutting into the eastern face of Swanbank Hill, on portion 12. It is apparently about 130 feet below the Swanbank No. 2 Seam, and this distance agrees well with the distance between Bergin's and the Striped Bacon Seams about Blackstone. I have no doubt that Perkins' Seam is the continuation of the latter. The seam does not show any workable section in the cutting mentioned above.

8. The Dinmore Seams.

COMPARISON WITH BUNDAMBA SEAMS.

As shown in the section treating of the general disposition of the Bundamba Beds, the north-eastern corner of this district is separated from the larger portion by a fault of considerable magnitude (the Dinmore Fault), which throws down the beds about Dinmore into a gently inclined position over a considerable area. In this area the New Chum Seam has been worked from a number of vertical shafts in the Whitwood, Dinmore, New Chum, and Ebbw Vale Mines. The extension of the workings to the north-east is again limited by a roughly parallel fault in the two latter mines, known as the Ebbw Vale Fault. The fall of the ground towards Six-mile Creek causes the New Chum Seam to crop to the surface in the gullies draining east into this creek. It was by drives into these outcrops that this seam was first worked, the workings gradually extending to the west and south and north. The relation between the New Chum Seam and those lying on the west of the field has long been a matter of conjecture, but recent work on the area has, I think, settled the matter with a considerable degree of certainty. A second fault, lying between the two main faults, but striking in a more easterly direction, and with a of them is thus rendered fitful, and necessitates their lying idle for many working days of the year.

The competition of the last five years has led to a gradual reduction of prices, from an average of 7s. 11½d. at the pit's mouth in 1899 to 5s. 11¼d. in 1904. Notwithstanding this great reduction in prices, most of the newer collieries have been able to open up their properties profitably, and have secured a large proportion of the trade. Thus the four new pits along the Aberdare Seam south of Blackstone produced in 1904 over 37 per cent. of the total output. Their operations have, I understand, been generally profitable, notwithstanding the initial expense involved in building spur lines to their pit mouths, and the erection of pit-head frames and haulage gear, and the greatly reduced prices of the coal. This has no doubt been possible by reason of the large quantities of cheaply workable coal provided by the outcrop of such a thick seam. The reduction in cost of coal to the consumer, though pressing hardly on operators accustomed to higher prices, was absolutely necessary in face of the keener competition of southern coal, induced by the general lowering of price there, and the removal of the import duty since federation. An average cost at the mines of 5s. 11¼d. per ton should prove sufficiently remunerative in the shallow workings of the Ipswich district were output continuous, and were the expenses of development and management not multiplied amongst so many small mines lying close alongside of each other, and often workable from the same opening.

As shown before, the chief hope of increased demand at present is that of a constantly enlarging shipping trade at the port of Brisbane. In this connection the extension of the run of the ocean liners of the Orient Company and their announced intention of making a trial of Ipswich coal are hopeful features. A few such regular customers, with facilities for rapid loading, would soon lead to a revival of trade, and put the industry on a more satisfactory footing. With the prospect of an expanding oversea trade from Southern Queensland, this field, situated as it is within a few miles of the port, and with large areas of cheaply-mined coal of good quality still untouched, should have a future of steady prosperity before it.

The Aberdare Seam at the present time furnishes nearly 58 per cent. of the total production of the field, two-thirds of its total coming from the four mines about Box Flat; another 21½ per cent. is derived from the New Chum Seam; so that these two seams furnish the bulk of the coal of the district. This circumstance is due to the fact that these seams are of first-rate quality for ordinary steam purposes, and on account of their both affording a considerable thickness of clean coal, they can be economically mined. Any immediate expansion of demand will, therefore, be probably met by increased drafts on these seams.

As shown before, the workings on the New Chum Seam have hitherto been confined to the ground immediately to the south and west of Dinmore. Recently, however, work has been extended to the west by the opening up of the Whitwood No. 2 shaft to the north of the railway line, and to the south by the Whitwood No. 3 and Rhondda shafts. In the latter direction the finding of the seam in good workable condition in the Rhondda Mine has opened up the probability of the existence over a large area of workable ground in the south-western corner of the field, none of which has as yet been prospected for this valuable seam of coal. Indeed, round the whole of the southern portion of the Cooneana Estate this seam has, as yet, not been prospected, its importance in this area having been overshadowed by the still more valuable and more easily traced Aberdare Seam, lately opened up in the collieries about Box Flat and at the head of Fernie Creek.

The outcrop of the Aberdare Seam, as shown on the map, runs down each side of the field in a roughly U-shaped line, the workings, as yet, all being north of the east and west road up Oakey Creek. To the north-west the country around Booval yet remains to be developed, while the northern extension along the eastern limb seems to be bounded by an area of poor coal as the outcrop approaches Six-mile Creek.

As previously shown, there is still a large area of country with coal at shallow depths east of the Swanbank line about Box Flat, while further south the outcrop of the seam has yet to be prospected over a long line extending up the flats of Bundamba Creek and round the southern portion of the map.

South of the Bonnie Dundee Mine no prospecting, except the shaft sunk by Mr. Binnie on portion 152, has as yet been undertaken; so that there is possibly a large area of shallow-lying coal along the outcrop here yet to be exploited, though the poor prospects found in this shaft are not very promising for this neighbourhood.

Besides these two seams of first-rate importance are the intermediate seams represented by the Four-foot and Bergin's Seams, which also contain valuable sections of coal in certain areas, and which have been worked with some success at detached points.

It is thus certain that the resources of the area embraced by the general map will be sufficient to meet any increase likely to occur in the demand for some years.

Brisbane, 30th September, 1905.

By Authority: George Arthur Vaughan, Government Printer, Brisbane.

J C Brunnich

Queensland.

DEPARTMENT OF MINES.

Geological Survey of Queensland.
(B. DUNSTAN, F.G.S., ACTING GOVERNMENT GEOLOGIST.)
PUBLICATION NO. 205.

SECOND REPORT
OAKS VIEW GOLD MINES
(NEAR ROCKHAMPTON).

WITH THREE PLANS AND TWO PLATES.

AND

NOTES ON THE MINES
TALGAI AND THANE'S CREEK GOLDFIELDS.

By LIONEL C. BALL, B.E.,
ASSISTANT GOVERNMENT GEOLOGIST.

BRISBANE:
BY AUTHORITY: GEORGE ARTHUR VAUGHAN, GOVERNMENT PRINTER, WILLIAM STREET.
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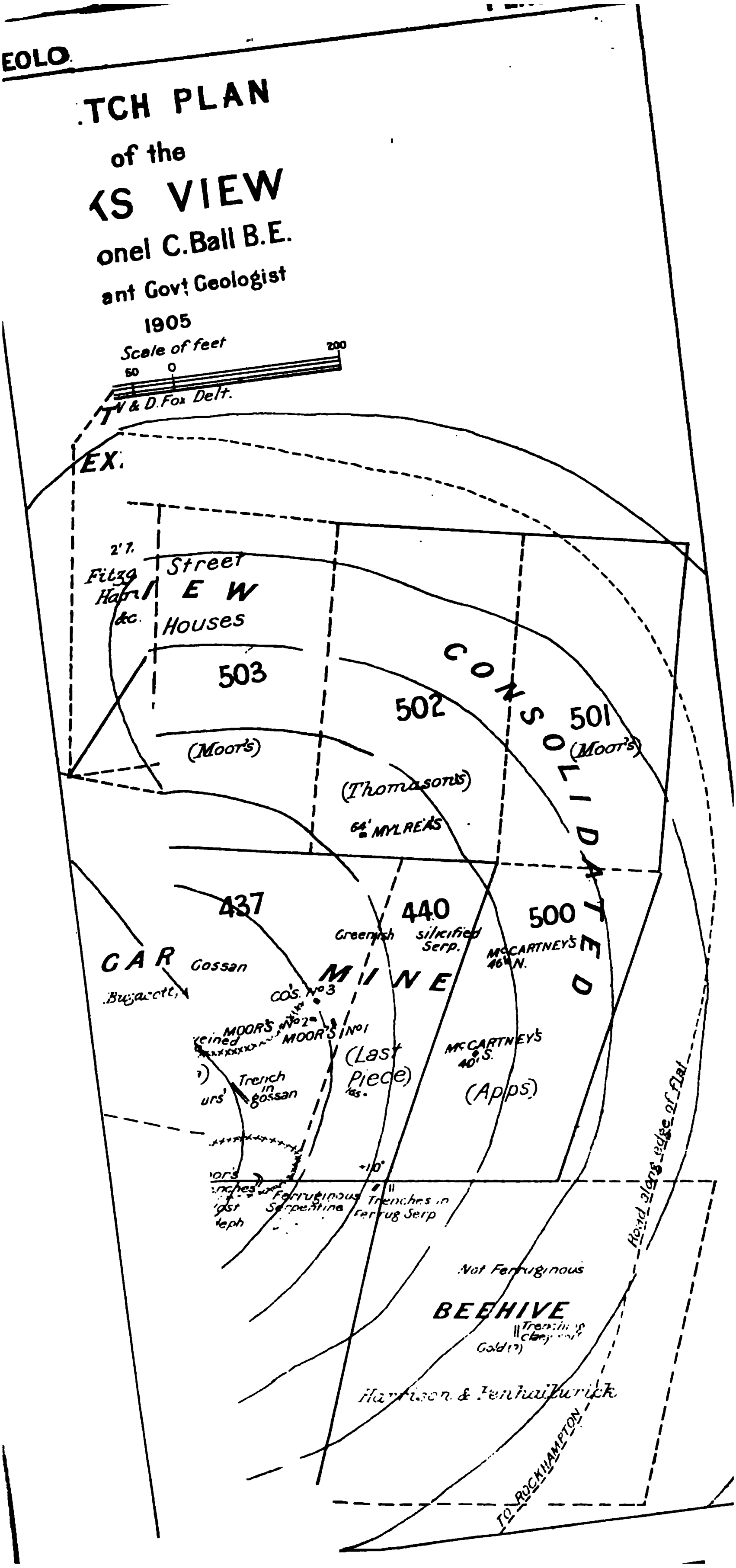
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onel C.Ball B.E.
ant Govt Geologist
1905
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502
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501
(Moor's)
CONSOLIDATED
437
440
500
CAR
Gossan
Bugacott,
Greenish
silicified Serp.
McCARTNEY'S 46' N.
MINE
CO'S. No 3
MOOR'S No 2
MOOR'S No 1
veined
(Last Piece)
McCARTNEY'S 40' S.
(Apps)
Trench in gossan
urs'
Ferruginous Serpentine
Trenches in Ferrug Serp
Not Ferruginous
BEEHIVE
Trenching Clay
Gold (?)
Harrison & Penhallurick
Road along edge of flat
TO ROCKHAMPTON

THE OAKS VIEW GOLD MINES.

I. INTRODUCTION.

Oaks View Hill, on which the claims are located, is on Grazing arm No. 1v, Canoona, which is distant from Rockhampton 45 miles r road. Further particulars as to locality, topography, history, &c., ill be found in a previous report.*

The population of the field at the beginning of September, 1905, s estimated to be eighty men, women, and children.

The Oaks View Hill, being outside of any goldfield, the ground n only be taken up and held as ordinary claims, under the regula- ns of the Mining Act, by possessors of miners' rights. Amalgama- n of these ordinary claims (200 feet by 400 feet) has now been rried out. The resultant extended claims are ten in number, and ver an area 1,800 feet from north to south and 2,800 feet from st to west.

There has been considerable agitation to have the workings in- ded in an extension of the Canoona Goldfield, which would allow of ses being taken up under a more satisfactory tenure. The employ- ent of two-thirds of the number of men (twenty-four) now compulsory uld then fulfil the labour conditions.

II. OAKS VIEW GOLD MINE (No. 441).

(The Oaks View Gold Mining Company, Limited).

1. Area.

This extended claim comprises:—

(*a*) No. 423, the combined reward claim and attached ordinary claim (700 feet by 400 feet), on the former of which are the main or western workings.

(*b*) No. 438, the "Crown of the Hill" (300 feet by 400 feet), on which there are no workings.

(*c*) No. 437, the "Eva" (300 feet by 400 feet), on which are the eastern workings.

(*d*) No. 440, the "Last Piece" (100 feet by 400 feet), on which there are no workings.

These extend from west to east along the brow of the Oaks View ill, on the northern side.

---

* Recent discovery of gold at Oaks View, near Rockhampton, by L.C.B., Brisb. Auth. 1905, p. 11, 2 plates. (G.S.Q.P. No. 199). *Also* Q'land Gov. Min. Jour., vi. (1905), p. 67.

2. WESTERN GROUND (No. 423).

The term western ground is generally employed locally in referring to the reward claim, there being no workings on the remainder of claim No. 423.

I. WORKINGS.

The main workings are on the north-western slope of the hill, just below the brow. They comprise three shafts, Nos. 1, 2, and 2A, with attached stopes, drives, crosscuts, &c., covering an area 240 feet long and up to 70 feet wide. (*See* Plan 1.)

Surfacing.—The surface soil to a depth of two feet has been removed (for crushing) over a distance of a chain west and north of No. 1 shaft. About 2½ chains north-west of No. 1 shaft a trench twelve feet long was sunk to a depth of 17 feet.

No. 1 Shaft (5 feet 6 inches by 3 feet) has been sunk vertically to a depth of 74 feet, the brace being five feet below that of No. 2 shaft. It was, when last seen, only 18 feet deep, but has since been deepened in search of a defined footwall. At a depth of 17 feet the shaft is connected with the stopes now extending downwards and eastwards to the No. 2 shaft (and thence north-eastwards to the No. 2A shaft). Besides the stope, which has an average width of about 25 feet, with a length of 70 feet, there are several radiating drives, with a total length of 150 feet, the positions of which can be seen on the accompanying plan (Plan 2). A crosscut runs 19 feet south 25° west from the bottom of the shaft.

No. 2 Shaft is slightly further up the hillside, the brace being 5 feet above that of No. 1, from which it is distant 54 feet east 6° north. It is 44 feet vertical to the stopes, which continue up to No. 1 and down to No. 2A shafts.

From No. 2 shaft a drive runs due north for 30 feet and south for ten feet. Then an inclined stope, gradually narrowing down to a drive, extends east-north-east for 47 feet, and at the bottom is a prospecting drive running 25° to the south-by-east. Two drives, ten feet apart, run ten feet to the west from the bottom of the inclined stope, and are then connected by an underlie 40 feet in length, from the upper end of which a crosscut extends 15 feet to the west-by-north. From the lower end of this underlie a drive, 40 feet in length, connects with No. 2A shaft, and the ore above it has been stoped out for a distance of 30 feet. Beyond the stope the drive extends 30 feet, and from it two crosscuts branch off, one, 35 feet in length, to the south-west, and one, ten feet in length, to the west-by-north. From the same drive west of the No. 2A shaft two inclines, thirteen and 20 feet in length, have been carried down on the ore, and from the bottom of the latter a crosscut has been carried back to the south-west for ten feet.

No. 2a Shaft lies 87 feet north 40° east of the No. 2 shaft. It is 89 feet deep, the brace being 18 feet below that of the No. 2 shaft. (*See* Plate 1.)

From the shaft a wide inclined drive runs easterly for ten feet, and then north-easterly for 30 feet, to a level opened 25 feet to the north-west and 18 feet to the south. At the western end of the level is a ten-foot crosscut to the south, while from the centre of the level a winze has been sunk 20 feet, and a drive carried 20 feet to the north-east.

II. ORE BODIES.

The western workings have proved a shoot of payably auriferous ore to extend from the No. 1 shaft nearly eastwards to the No. 2 shaft, with an average width of 25 feet. Beyond the No. 2 shaft the run has trended more to the north-east. In the No. 2A workings the rich shoot appears to have a width of 30 feet or more. The greatest width proved by stope and drive in the No. 1 workings is 50 feet; in the No. 2 workings 45 feet; and in the No. 2A workings 70 feet: while on the bottom level 40 feet has been exposed.

The method hitherto adopted having been to follow the richest gold, little is known as to the extent of the "pay ore." The thickness may be gauged by the height of the stopes—four to six feet (and even ten feet); and it may be taken to average five feet six inches, varying as it does between four feet in the upper and ten feet in the lower workings.

The No. 1 shaft sinking comprised:—

Gossan, from the surface to 45 ft. depth ...	Occasional colours of gold.
Serpentine (9 ft.) to 54 ft. depth	
Gossan (10 ft.) to 64 ft. depth	
Kaolinised ferruginous serpentine (10 ft.) to 74 ft. depth	

The drive passed from serpentine to gossan within ten feet, and, after three feet, into ferruginous and cherty quartzose ore. This is very promising in appearance, being identical with ground proved rich in the No. 2A workings; but a sample taken by me was crushed and washed for only traces of gold. The dip of the whole is from 45° to 60° to the north-east, so that the belt of serpentine in which sinking ceased should be at least 20 feet thick.

The deeper workings are important, as they prove the gossan and intercalated layers of serpentine to have a thickness of at least 60 feet; and, though poor in the drive, very little additional exploring might reveal rich ore.

The floor of the No. 1 stope is formed by a lenticular layer of serpentine, which cuts out to the north-east of the No. 1 shaft. It is, therefore, within the bounds of possibility that "pay ore" may be found beneath that serpentine.

At 15 feet from the surface in No. 2 shaft, a four-foot quartz reef was cut through, while beneath it was auriferous gossan, which was not properly tested because the shaft was being sunk to the bottom of the

No. 1 stope for ventilation. It is now believed that this gossan is the same as that being worked below No. 2A shaft, and that two distinct gold-bearing layers have been worked—that in the No. 2A workings being an upper, and that in the No. 1 workings a lower. The present workings connecting No. 2 and No. 2A shafts are in country separating the two auriferous zones.

In the No. 2A shaft the lode material was cut, beneath a six-foot quartz reef, at 83 feet from the surface, and was sunk in for six feet. The quartz reef is being left standing, as it forms a splendid roof. It is presumed to be that cut in the No. 2 shaft at 15 feet depth.

The evidence of the workings shows the trend of the ore body to be not towards the eastern workings, but towards the Magazine Rock on the south-east. The network of quartz veins in the serpentine there may be taken to represent the solid quartz vein found in No. 2 and No. 2A workings. It has, however, yet to be proved that the gold persists as well as the gossan and quartz. Some prospecting was done in the vicinity of the Magazine Rock twenty years ago; but, though the ore appears promising enough, the gold is absent, or present only in small quantities. Similarly the work towards the north-west has been discouraging. The stone from the deep trench to the north-west of the No. 1 shaft was crushed for an average yield of 3 dwt. per ton—that on the surface carrying 6 gr. to the dish (1½ oz. per ton), while that beneath decreased in value rapidly. This would indicate that the ore body should be expected rather to the west than the north-west of the workings.

Gossan does occur at intervals between the western and eastern workings, and gold has been found in the soil along the whole of the northern side of the Oaks View Hill; consequently there seems to be more likelihood of gold being found in an east and west belt than along the true strike to the north-west and south-east, but nothing has been done to prove the existence of ore deposits.

III. ORE.

The ore is, in main part, a gossan, consisting as it does of a siliceous framework filled in with ferruginous clay. Patches of unaltered serpentine and flecks of a green chrome-bearing silicate are distributed irregularly through it, and crystalline quartz of two growths can be washed out of the ore from the bottom level. The most promising stone is cellular gossan (palpably leached serpentine), containing streaks of dark-coloured magnesian silicate, and veined to a large extent with granular blue quartz, the thin (⅛-inch) lenticular leaders showing no orientation. The bulk of a ton of gossan, as sent to the mill, has been determined by Mr. O'Meara to be 34 cubic feet.

The reef is simply serpentine, veined and almost entirely replaced by quartz; and that the replacement has taken place along a fissure is indicated by the splendid footwall (and hanging-wall also) with attached polished flucan.

rich elsewhere, and as I was not informed of the fact that fair prospects were obtained only from the manganese-stained gossan within a few feet of the inner end.

V. OUTPUT.

From the surface:—

345 tons yielded ... ... 85 oz. = 5 dwt. per ton.

Surface to 44-foot level:—

1 ton 12 cwt. dish tailings yielded 19 oz. = 11 oz. 17 dwt. per ton.
160 tons yielded ... ... 305 oz. 4 dwt. = 1 oz. 18 dwt. per ton.

February to December, 1904:—

Prospects washed in dish ... ... 327 oz. 4 dwt.
Making a total of ... ... 651 oz. 8 dwt. = 4 oz. per ton.

44-foot level to 101-foot level:—

318 tons yielded ... ... 342 oz. = 1 oz. 1 dwt. per ton

101-foot level to 146-foot level:—

387 tons yielded ... ... 475 oz. 11 dwt. = 1 oz. 4 dwt. per ton.

Total to the end of September, 1905:—

1,211 tons 12 cwt. yielded 1,228 oz. 15 dwt. = 1 oz. per ton.

The above returns were given me by the manager (Mr. O'Meara). The monthly returns from the secretary (Mr. Catt), which include both eastern and western crushings, are:—

1905, Jan.:	119	tons for	227 oz. 6 dwt.	= 1 oz. 18 dwt.	per ton.
March:	380	,,	130 oz. 14 dwt.	= 6 dwt. 20 gr.	,,
April:	86	,,	62 oz. 18 dwt.	= 14 dwt. 15 gr.	,,
May:	96	,,	34 oz. 0 dwt.	= 7 dwt. 2 gr.	,,
June:	122	,,	267 oz. 0 dwt.	= 2 oz. 4 dwt.	,,
July:	96	,,	202 oz. 10 dwt.	= 2 oz. 2 dwt.	,,
Aug.:	142	,,	128 oz. 0 dwt.	= 18 dwt.	,,
Sept.:	149	,,	144 oz. 17 dwt.	= 19 dwt. 11 gr.	,,
	1,190	,,	1,197 oz. 5 dwt.	= 1 oz.	,,

The value of the gold washed out by the prospecting syndicate was £3 10s. per oz., while that of the ingots sent from the mine varies between £3 10s. and £3 15s., the average being £3 14s. per oz.

3. EASTERN GROUND (No. 437).

The eastern ground comprises claims Nos. 437 (the "Eva") and 440 (the "Last Piece"), on the the latter of which no work has been done.

I. WORKINGS.

Work was begun by Moor on the "Eva," but some work has lately been done by the company, the location being almost 1,100 feet east of the western workings. (*See* Plan 3.)

Moor's No. 1 shaft is 18 feet deep (vertical), and underlies 1 in 1 for 15 feet.

Moor's No. 2 shaft, 25 feet to the west of No. 1, is really only a few feet deep, but connects with No. 1 at the 17-foot level by an irregular stope.

PLAN 3

SKETCH PLAN

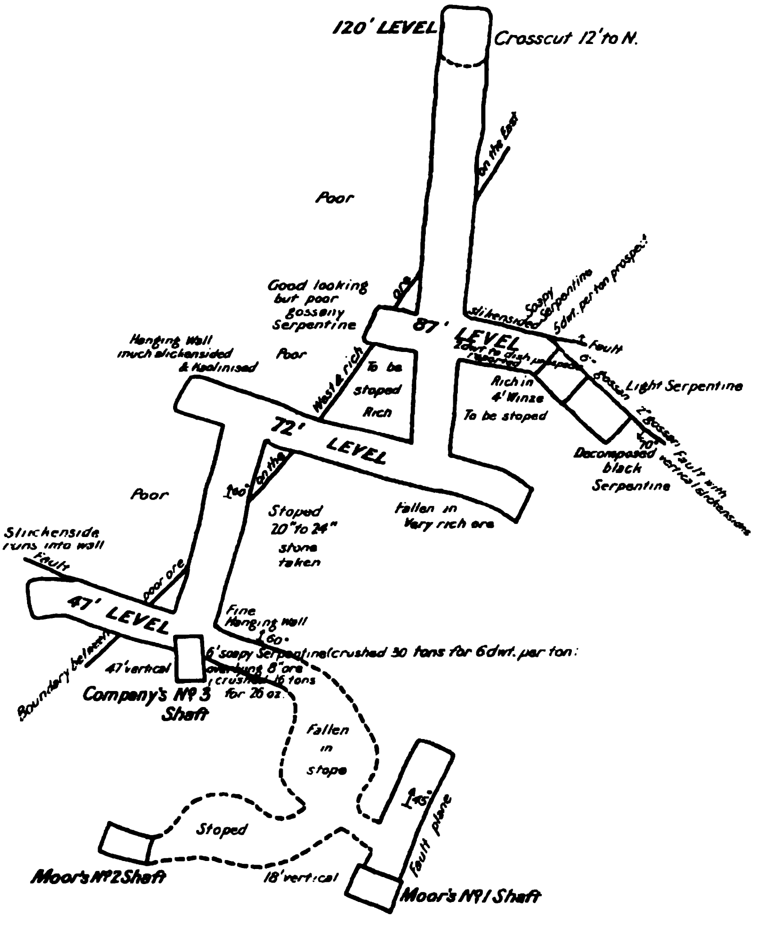
on the plane of the underlie

EASTERN WORKINGS

Oaks View G.M.Co.

By Lionel C. Ball B.E.
Assistant Govt. Geologist
1905

Scale 20 feet to an Inch
20 10 0 20



The Company's No. 3 shaft, 30 feet north-west of Moor's No. 1, is vertical to 47 feet depth, at which point a level runs 16 feet westwards and 18 feet eastwards to a small stope connected with Moor's No. 1 and No. 2 shafts. The shaft continues northwards on the underlie (at an angle of 60°) for 24 feet to a second level extending five feet westwards and 25 feet eastwards. From this level, at 17 feet from the underlie shaft, an underlie winze descends 48 feet, there being levels five feet west and 22 feet east and south-east at 14 feet below the 72-foot level.

Much of the stone hitherto crushed has come from the stope between the 47-foot and 72-foot levels.

II. ORE BODY.

The eastern workings are located upon a single shoot, which pitches towards the north-east. The width of the shoot was 24 feet on the 47-foot level and 30 feet on the 72-foot level, but on the 87-foot level only 15 feet has yet been proved. The thickness of ore broken down between the 47 and 72 foot levels was from 20 to 24 inches.

In the Company's No. 3 shaft the sinking from 12 to 20 feet was through cherty country, beneath which is four inches very rich, soft, clayey, gossany slate and ironstone, dipping north-easterly; gossany material underlies this to the shaft bottom.

On the 47-foot level, however, no fault can be seen between the ore body and the solid black serpentine footwall, and none between the ore and the crushed serpentine on the hanging-wall, but a well-defined fault plane separates the crushed serpentine from the overlying rock.

The lower workings are undoubtedly on a line of faulting, the foot and hanging walls both having considerable slickensides and flucan.

On the 87-foot level some confusion has been occasioned by an oblique fault from the south-east, which has been followed instead of the main fault, the gold having in consequence been lost. This fault shows strong vertical slickensides.

Both hanging-walls and footwalls in the lower levels are crushed (slickensided) serpentine.

A black manganese-stained siliceous skeleton, forming a vein from two to eight inches thick, and at any distance within six feet of the fault, but generally forming a footwall for the auriferous ground, is looked upon as an " indicator " here.

III. ORE.

The ore is similar in appearance to that at the western end, the original serpentine having been, however, not quite as thoroughly leached and altered.

Much of the gold here occurs painted on the " faces " of fissures in the serpentine and ferruginous slate. Rich gold has also been found in the flucan of the hanging-wall on the 81-foot level; and on the 47-foot level six feet of crushed soapy serpentine, having to be removed, was milled for a return of 6 dwt. per ton.

IV. OUTPUT.

22 feet to 84 feet:—

52 tons for 61 oz. 10 dwt. = 1 oz. 4 dwt. per ton.

Lowest portion of stope and 24-feet level:—

October, 1905—22 tons for 45 oz. 10 dwt. = 2 oz. 1 dwt. per ton.

47-foot level:—

16 tons for 26 oz. = 1 oz. 12½ dwt. per ton.
30 tons for 9 oz. = 6 dwt. per ton.

4. EXPLOITATION.

The ore has hitherto been got with little or no system. A shaft was first sunk in the outcrop of the western ore body. Samples were then taken from the face and panned off without a preliminary crushing, a drive (sometimes opening out into a stope) being then opened on the side where the richest prospect was found. Each day the faces were prospected by sampling (three dozen places sometimes), and the direction of the work altered accordingly, so that even now some parts of the workings have much resemblance to a rabbit warren. When ventilation became impaired and haulage began to become difficult, a second shaft was sunk to the lowest end of the first workings, and work was then continued to the dip. Thus, shafts Nos. 2 and 2A have been put down, and it seems likely that another will soon be required. Drives and inclines (located on richer strings of gold) branch out from the stopes in all directions, and six crosscuts have been carried back into the poorer gossan in search of a footwall.

Three shifts are now at work in the bottom crosscut, each containing two men picking down the ore, one man filling the greenhide buckets at the shaft, and two men on the brace hauling. There is a sampler on the day shift, and when work is going on fully four additional men are employed in the mine.

As mentioned elsewhere, the samples taken daily in the mine are washed without a preliminary crushing, it having been found (by crushing check samples) that, if the prospect is poor from an uncrushed sample, the crushed ore will give a result very little better. Most of the gold must, therefore, occur in the soft earthy portion of the ore, and not in the quartz veinlets.

Just previous to my visit exemption had been secured, because of the want of water, but an opportune storm had replenished the dam, and crushing had been resumed, though only partial work was going on in the western ground, and none in the eastern.

5. TREATMENT.

I. TRANSPORT.

The ore is raised in greenhide buckets by windlass, and is carted from the shafts down the hill to the boundary of the machine area, where it is tipped on the ground. It has then to be loaded on a small trolly running on rails to the automatic feeders. It is thus evident

intended to be 100 feet in length, has been opened out 18 feet under the flat on the north. The quantity being raised (6,000 gallons per 24 hours) about equals the loss from evaporation in the dam.

III. OAKS VIEW CONSOLIDATED (No. 517).

1. AREA.

The Oaks View Consolidated (claim No. 517) adjoins the Oaks View on the north and east, and comprises claims Nos. 508 (originally Nichol's), 507 (originally Cohen's), 506, 505, 503, 502 (originally Homeward's and Mylrea's), 501, and 500 (originally McCartney's). It is now held by the Oaks View Gold Mining Company, but all the work on it was done by the former holders.

Workings are to be seen on Nos. 508, 507, 502, and 500; but none of the shafts could be descended. On Nos. 506, 505, 503, and 501 practically no work has been done, even in prospecting the surface.

2. NICHOL'S (No. 508).

Workings.—Nichol's shaft (41 feet below No. 2) is situated 260 feet north-north-east of the No. 1 shaft on the reward claim.

It is now inaccessible (having been abandoned because of water trouble), but is reported to be 118 feet deep. Water-level is at 102 feet beneath the surface. The Company has done nothing on this ground, but the manager intends to put men on to prove it as soon as circumstances will permit.*

Ore Body.—It is understood that this shaft passed through a quartz reef into an ore body similar to that in the western workings (on the reward claim). The ore on the surface, said to have come from 118 feet depth, is identical in appearance with that in those workings, and good prospects of fine gold can be washed from it. The ore bodies of the reward claim should not, however, be struck here at much less depth than 200 feet from the surface, unless a very considerable flattening takes place.

3. COHEN'S (No. 507).

Workings.—Cohen's shaft, 45 feet below No. 2, lies 360 feet east-south-east of Nichol's. The reported depth is 130 feet. The shaft is inaccessible, work having been stopped because water was struck.

Ore Body.—The sinking seems to have been in light brown and sometimes greenish altered serpentine. The last few bucketsful raised consist of leached, quartz veined, and banded black gossan, which carries very good prospects of flour gold. Flour gold (which is considered a good sign) was reported at a depth of 120 feet, and "colours" between 100 and 130 feet. It is to be hoped that further prospecting work will be undertaken here, both in the ore found and in further sinking the shaft.

---

* December, 1905: Mr. O'Meara informs me he is driving S.W. at 100 feet depth.

4. MYLREA'S (No. 502).

Workings.—Mylrea's shaft is 210 feet north-north-east of the company's No. 3 shaft (at the eastern end). It is 64 feet deep.

Ore Body.—Though gossany, quartz veined, and replaced serpentine has been raised, from below ferruginous serpentine in the sinking "pay ore" has not been reported.

5. McCARTNEY'S (No. 500).

Workings.—The northern shaft lies 230 feet east by north of the company's No. 3 shaft. It is 46 feet deep.

The southern shaft, 110 feet to the south-south-west, is 46 feet deep.

Ore Bodies.—The northern shaft was sunk to a blue quartzite (replaced serpentine) in the gossan, above which gold has been found. Chalcedony, zoned and faulted, and also magnesite, are to be found on the tip from this shaft.

The southern shaft is understood to have been sunk on the division between auriferous stone (fair prospects), and serpentine for 18 feet at least above bottom. The serpentine at bottom dips north-eastwards.

IV. FEDERATION AMALGAMATED (No. 490).

The claim is irregular in shape, being 400 feet wide and 500 feet long. It includes the ground formerly held by Hyde and Clark and Hinze and Pacey, and adjoins the reward claim on the west. The claim, being under exemption, was unmanned when inspected, and of the shafts only Hinze's and Pacey's could be descended.

1. HYDE'S AND CLARK'S.

The shaft (about 25 feet below No. 2 of the Company), in the north-eastern corner of the claim, was abandoned at 105 feet, because of water inflowing.

At 20 feet (?) depth, 20 feet of quartz and quartz-veined country (which outcrops about 50 feet up the hillside) was struck. The quartz is cherty, with bluish manganese stains, and contains green silicates. Prospects of gold were found, so it was paddocked, but a surface sample of the quartz in the paddock (believed to carry 7 dwt. per ton) yielded (Government Analyst):—

Gold, Nil; Silver, Trace

The gossan was not sampled, though reported to be auriferous.

2. EVA'S.

The shaft is near the centre of the reward claim boundary, and was, in fact, sunk by the prospectors. It is twelve feet deep.

A sample was taken from the gossan thrown out of the shaft and panned off for a trace of gold.

3. Clark's.

The shaft lies about a chain west of Eva's. It is only a few feet deep.

A sample of the gossan on the brace was panned off, but yielded no gold.

4. Hines's and Pacey's.

The shaft (about 25 feet below the company's No. 2) is located in about the centre of claim No. 490.

It is vertical for ten feet from the surface, and then underlies at 75° (to the north 25° east) for 40 feet. Levels have been commenced at 20 feet, 30 feet, and 45 feet from the surface (15 feet, 25 feet, and twelve feet in length). The proposal for the future is to sink a shaft 50 feet to the north of the present one, to cut the reef at a slightly greater depth than the underlie workings.

A couple of feet of gossan forms the hanging-wall; this is altered serpentine, and is very promising in appearance, but it contains only odd colours of gold. Beyond this is two feet of slickensided rotten serpentine, with laminated green chrome (?) silicate, and then gossan again. The footwall is also formed by gossan.

The reef is very bulgy, varying from six inches (or less) to six feet in thickness, while the average is two feet. There is no sign of fissure, except occasionally centrally in the vein. The footwall is unusual, in that it breaks from six inches to a foot into the reef every few feet as the descent is made, while the hanging-wall remains unbroken.

The quartz is sometimes similar to that in the No. 2A workings, in being cellular. It contains solid limonite and bunches of green chrome (?) silicate. The best gold is found where the reef is thin. A test was made in the Oaks View United mill of—

13 tons, which yielded ½ oz. per ton.

and 40 tons of similar stone now lies at grass, as ½-oz. stone would not pay to work on a small scale.

V. O'MEARA'S (No. 513).

The claim is 200 feet by 400 feet in area, and adjoins the reward claim on the north, and the Consolidated on the west.

The only work (the sinking of about a dozen shallow shafts (4 feet 6 inches by 2 feet) hitherto done has been in search of alluvial, in a small gully running northwards from the western workings.

Near the reward claim the gold is found at a depth of from three feet to eight feet, but on the flat nearer the battery it is being found at 16 feet beneath the surface. No defined run has been found, but the whole of the gold is believed to be within the confines of the claim, the lowest shaft being a duffer. The gold is fairly coarse (¼-inch diameter), is only slightly rounded, and has evidently been shed from the western ore body. Only 1½ oz. had been saved at the end of October, 1905.

VI. TARCOOLA (No. 518).

Claim No. 518 is 400 feet by 400 feet in area. It adjoins the north-western corner of the reward claim.

The only work done on this claim has been the sinking of three holes to six feet depth. In one of them there is said to be a leader, but only slate and quartzite are now exposed, though occasional fragments of gossan (said to be auriferous) are found in the soil. The ground is probably held for the purpose of proving at a depth any deposit that may be brought to light on the adjoining Federation Amalgamated.

VII. TARCOOLA EXTENDED (No. 519).

This claim has the shape of a rhomb, with sides 400 feet in length. It adjoins the Tarcoola and Federation Amalgamated on the west.

In the eastern corner a two-foot trench has been opened across a quartz outcrop, the total width of which is 17 feet 6 inches. The quartz, much of which is slightly chalcedonic, is evidently replaced serpentine, and differs from that in the western workings on the reward claim, which is only partly replaced. A sample was taken from the whole length of the trench, but yields (Government Analyst):—

Gold, Nil; Silver, Trace.

The hanging-wall side of the reef is beautifully polished, proving it to be on a line of movement of some extent. Its dip is 42° to the north 50° east. It is thus probably the same reef as worked in Hinze's and Pacey's shaft on the Federation Amalgamated. Adjoining the reef on the north-east is 2 feet 6 inches of rotten, green, silicate-bearing serpentine, under a six-inch leader. This seems more likely to prove auriferous than the reef itself, and prospecting (with the dish) of the surface soil along both sides of the quartz reef is therefore advised.

VIII. GARDEN.

This claim, 400 feet by 800 feet in area, is the last pegged out. It lies south of the Federation Amalgamated, and west of Penhallurick's Extended Gold Mine No. 4.

No work has yet been done here.

IX. PENHALLURICK'S EXTENDED GOLD MINE, No. 4.

The claim is 400 feet by 200 feet, and is situated at the south-western end of the reward claim.

No work has yet been done here.

X. BEEHIVE.

The area of this claim is 400 feet by 400 feet. Its location is adjacent to the south-eastern corner of the Oaks View, and south of the Consolidated.

There is a trench in ferruginous serpentine in the north-western corner, and a trench was being made in the centre of the claim when I left the field, but it had not then passed through the soil.

XI. OAKS VIEW SOUTH EXTENDED UNITED GOLD MINE (No. 514).

The claim is generally known as Penhallurick's. It has an area of 800 feet by 400 feet, and adjoins the Oaks View Gold Mine on the south. Only southern slopes of the Oaks View Hill are included within its limits.

The only prospecting work done on this claim has been the opening of a few trenches near the hilltop, just within the northern boundary. The gossany and quartz-veined outcrops here are promising enough, but I am not aware of any gold having yet been found.

The original prospectors of the "Crest of the Hill" sank a shaft to a depth of 20 feet on the hilltop, in what is now the north-eastern corner of this claim. They found only light, rotten serpentine.

The present holders are now opening an adit half-way down the hillside, in the eastern part of their ground in the hope of striking, within 300 feet, the extension of the ore body of the reward claim.

XII. TINKER'S HILL.

Tinker's Hill, a mile north of the Oaks View Hill, received attention from a party of prospectors, and was, therefore, inspected. It consists chiefly of schist and quartzite, and the only trench opened is in an outcrop of the latter rock. Colours were once reported, but no gold can now be found, and the claim is expected to be abandoned.

Black's Hill lies $\frac{3}{4}$-mile east-north-east of Tinker's Hill. It is composed of ferruginous shale and quartzite. Colours of gold were said to have been found on it, but no confirmation can be had of the rumour.

30th November, 1905.

NOTES ON THE MINES

TALGAI AND THANE'S CREEK GOLDFIELDS.

By LIONEL C. BALL, B.E.,
ASSISTANT GOVERNMENT GEOLOGIST.

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NOTES ON THE MINES

TALGAI AND THANE'S CREEK GOLDFIELDS.

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INTRODUCTION.

The following notes were prepared while on a brief visit to the fields in August, 1905:—

On the return journey a correction was made in the delimitation of the granite area on the Warwick-Goondiwindi Railway, such area being observed to extend between the 17½-mile peg (two miles beyond Cunningham) and the 22¾-mile peg (one mile before reaching Thane). The granite is a typical coarse biotite variety, apparently occupying the floor of the wide, flat, fertile valley stretching some six miles south of the railway. The glimpses of the cuttings obtainable from the moving train point to the granite being intrusive in the slates and quartzites of the Thane's Creek and Talgai Goldfields. To this intrusion may naturally be ascribed the occurrence of the reefs in the slates, which may, therefore, become more permanently defined as the granite is approached.

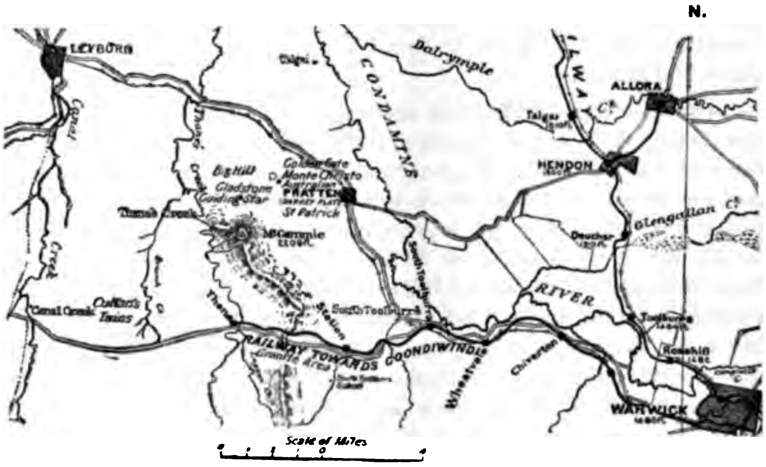

Fig. 1.—Local sketch, showing position of Cullan's Twins, etc.

MONTE CHRISTO, ETC.

The Monte Christo lease adjoins the Big Hill lease on the south, and lies about three miles west of Pratten, the commercial centre of the Talgai Goldfield.* The present holders bought the property from the liquidators of the Pratten Gold Mining Company.

Within its boundaries three lines of reef have been worked, and there are still other outcrops.

1. MONTE CHRISTO.

An application was made in July, 1905, for Government assistance to the extent of £300 to continue the new vertical shaft from 174 feet to 270 feet, at £4 per foot, and to crosscut north and south. In my report on that application I advised that prospecting should first be done on the reef where exposed in the old workings.

New Workings.—The new vertical shaft (begun in 1903 because the old workings were then inaccessible and believed to be unsafe) is 6 feet by 3 feet, part timbered, of two compartments, and provided with windlass and whip. It lies 2½ chains distant to the south 20 degrees west from the fifth shaft from the eastern end of the Monte Christo workings. In it the only change (from grey, sandy, slate grit) is at 25 feet from the bottom, where there is a one-foot band of white kaolinised rock, dipping 40 degrees to the south-east. This indicates the proximity of the Monte Christo reef and leaders. Taking everything into consideration, my calculations indicate that the reef should be struck at about 18 feet below the shaft bottom—*i.e.*, at a depth of 192 feet.

Old Workings.—The only shaft now accessible is the third from the eastern end of the workings, and lying north 44 degrees east of the new vertical shaft. It is vertical for 26 feet, at which point the reef was struck, and from which it was followed to the bottom on the underlie for 15 feet at 56 degrees (then stopes lying on both sides), for 15 feet at 35 degrees, for 20 feet at 45 degrees, for 30 feet at 53 degrees (stoped only down ten feet), and for ten feet at 35 degrees to the bottom (several (?) feet filled in), the total vertical and underlie being 117 feet. The angle of dip thus averages about 45 degrees. A drive was carried along the reef to the east from the foot of the underlie for about 50 feet, where, on a local bend, the dip is 63 degrees to south 20 degrees east. About 33 feet from the underlie is a stepped winze 20 feet deep, the bottom of which is connected with the eastern shaft (90 feet from that last descended). From this eastern shaft a crosscut 165 feet in length runs out to the south, in the search for a large but poor reef, to be seen on the surface near the shaft.

At 60 feet vertical depth is a crosscut in the hanging-wall, in which at 30 feet from the underlie a leader dipping 40 degrees to south-west was met. A big chamber has been excavated at the level of the bottom of the main underlie, though it is reported that the leader was generally only a few inches thick. It is probable that branch leaders proved auriferous near the main leader.

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* See late Discovery of Gold near Pratten, Talgai Goldfield, &c. (G.S.Q.P. No. 186.)

Reef.—The Monte Christo reef near the top of the underlie is seen to be only two inches thick, but at the eastern end of the 117-foot level is twelve inches and more, of hungry, glassy quartz. At the foot of the shaft there seems to be a branch running off into the hanging-wall. The reef is 18 inches thick at the eastern underlie, and on the level connecting this shaft with the winze one to three feet of iron-stained quartz is exposed, dipping about 45 degrees. A small sample taken by me gives (Government Analyst)—

Gold	19 gr. per ton
Silver	1 dwt. 19 gr. per ton

It is, however, said that the gold was not found in the main reef, but in the stringers bulging off into the hanging-wall, so that the poverty of the above sample must not be taken as altogether condemnatory. In order to test the reef, the whole of the drives and faces should be cleaned up and sampled. Then the underlie should be continued, and drives carried along the reef.

Output.—The total recorded output from the reef is very small. Mr. Rands* gives the yield from 1866 to 1897 as—

244½ tons for 1,222 oz. 3 dwt. = 5 oz. per ton.

The country rock over the greater part of the workings is a white, sandy, kaolinised slate—probably slate altered by thermal solutions—but at the eastern underlie the hanging-wall rock is bluish-mottled slate, very similar to that at 174 feet depth in the new vertical shaft. Further out along the crosscut thin bedded quartzites can be distinctly seen to dip 65 degrees to south-south-east. The reef may, therefore, be on a strike fault.

2. WELCOME STRANGER.

These workings lie 300 feet to north 255 degrees east of the new vertical shaft referred to in the description of the Monte Christo.

Workings.—The two shafts—the prospecting and whip—lie 44 feet apart on a west 10 degrees south line, the former 15 feet deep and the latter 70 feet. The Pratten Gold Mining Company sank the prospecting shaft several feet up the hill—*i.e.*, to the eastward of where the original patch of gold was found on the surface. A well-defined twelve-inch lode was struck at 15 feet depth, and was followed on the underlie to 50 feet depth. At this point the present holders broke down several tons. They then, on the east, sank the vertical whip shaft to 70 feet, and from the bottom opened an inclined stope for 25 feet to the east, reaching five feet below the shaft bottom. In the eastern face of this stope is a crosscourse striking north 15 degrees west, and dipping 85 degrees to west 15 degrees south, and this crosscourse cuts off a large body of barren quartz.

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* Big Hill Gold Mining Company's Lease, Talgai. By W. H. R. 1898. Bris.: By Auth. (G.S.Q.P. No. 128.)

Reef.—In the prospecting shaft the lode is plainly twelve inches wide, but in the whip shaft only two inches of rubbly quartz and limonite was cut. It is, on the whole, vertical, any inclination observable being to the north. The footwall is good, but there is no sharply-marked hanging-wall. The auriferous stone in the company's stope generally followed (lying about six feet above) a floor dipping to the east. The shoot was very flat, its inclination being only about one in four horizontal; and it is therefore probable that the whip shaft has been sunk through it. The lower stopes are therefore below the general run of the gold, for the flat floor referred to crosses the shaft above those stopes. One patch of gold was, however, found in the whip shaft below that floor. Wherever gold was found the enclosing material was clayey, and it was always moist. The metal is also generally associated here with ironstone.

Output.—The output of the Pratten Gold Mining Company is understood to have been 68½ oz., chiefly from two or three pockets in the stope below the prospecting shaft. At 62 feet depth in the whip shaft a patch of 100 oz. of gold was found in a three-inch band of rotten rock, and 3½ tons of stone secured from the vicinity yielded 20 oz. 8 dwt. of gold, valued at £3 19s. 6d. per oz.

The value of the gold won hitherto is about £750, while the mining costs probably did not exceed £200. The property should therefore be worth developing to some extent by sinking and blocking out, instead of opening out large chambers without method, as was done below the whip shaft in the search for bunches.

3. CLARE'S.

This reef passes within three feet of the brace of the new vertical shaft on the Monte Christo lease, and should be cut by a 60-feet crosscut to the south on the 174-feet level, but it has not been sufficiently prospected on the surface to encourage the project of crosscutting.

A shaft on the reef, 17 feet deep, lies 41 feet to the south 75 degrees west of the new vertical. In it is exposed nine inches to twelve inches of solid white pyrite-bearing quartz, with two inches of limonite and bluish quartz against a rotten slate footwall, dipping 70 degrees to south 2 degrees east. A sample from the bottom of the shaft yields (Government Analyst) only traces of gold and silver, but that does not prove the reef unworthy of further testing.

An old shaft adjacent to the above is said to be 40 feet deep, and to have given several small crushings.

GOLDEN GATE.*

This five-acre lease lies adjacent to the Monte Christo, on the eastern side. The workings lie in the south-western corner, and have been all carried out since my last visit. The reef was discovered by prospecting the soil with a pan, the twelve-inch outcrop, two chains west of the present workings, being presumably poor.

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* See G.S Q.P. No. 186.

Workings.—These workings comprise two shafts 54 feet apart, the eastern (or prospecting) shaft being 30 feet deep, and the western (or whip) 60 feet deep. The shafts are connected at the bottom by an inclined crooked drive, and also at the 20-foot level. The ground between the shafts has been irregularly stoped to the surface. Further sinking is necessary, with drives east and west, and it will probably be necessary to break down several feet of interlacing leaders and country rock.

The prospecting shaft was begun in the footwall, and struck the reef dipping south-eastwards at ten feet. After a few feet the reef became vertical. It here consists of six feet of altered country, traversed by a network of leaders.

The whip shaft was begun in the footwall, and at a depth of 20 feet struck the reef dipping north-westwards.

Reef.—The workings show that there is here a band of altered country (running west 30 degrees south, and practically vertical), with numerous quartz leaders six inches or less in thickness, one or more of which may be auriferous for some yards till intersected by another, which then carries the gold till crossed again itself. Small lenses of quartz beside the main leaders are sometimes found to be gold-bearing. The reef along the bottom workings is poor, but as the owner was unwilling to have it sampled I cannot give the contents.

The presence of a slickensided plane indicates that the leaders are on a fissure zone, conforming in many particulars with the Monte Christo, especially in the country rock, which in the vicinity of the auriferous shoots is brown decomposed sandy slate, but westwards is white clayey, with small nodules of unaltered quartzite.

Ore.—The quartz is glassy, some of it pink, some blue, and some white, but all emitting, when freshly broken, a distinct odour of sulphuretted hydrogen. It has a banded appearance, and seems to be in process of replacing the country rock. The best gold is found where there are strong dendritics (manganese dioxide) in the altered country rock. It is all invisible, occurring most plentifully in bunches of glistening black limonite in the quartz, much of the gold dollied out of the stone being coated with iron oxides. It has also been found that near where the gold is richest is a thin band (up to one foot in thickness) of hard "casing," beyond which the country rock is quite soft and decomposed. As already mentioned, the gold leaves a leader wherever it branches or is intersected by another.

Three auriferous shoots, all pitching steeply south-westwards, have so far been followed between the shafts. In that nearest the whip shaft two feet six inches stone yielded 2½ oz. per ton for a few feet. West of the whip shaft the reef, part of which is pyritous, becomes very poor, 12 to 18 inches of stone being left standing for that reason, though adjacent thin leaders carry comparatively good gold. Again, six feet east of the prospecting shaft, the main leader pinches down to one inch, and there the country rock is quite unsoftened.

Output.—The following crushings were made at Hart's battery, on Thane's Creek:—

7 Dec., 1903	.. 9½	tons crushed for	9 oz. 14 dwt. 1 gr.	= 1 oz. per ton
7 Mar., 1904	... 12	,, ,,	17 oz. 10 dwt. 6 gr.	= 1 oz. 9 dwt. per ton
27 June, 1904	... 8	,, ,,	19 oz. 18 dwt, 15 gr.	= 2 oz. 10 dwt. per ton
13 Feb., 1905	... 15½	,, ,,	39 oz. 4 dwt. 6 gr.	= 2 oz. 10 dwt. per ton
	45	,, ,,	86 oz. 8 dwt. 4 gr.	= 1 oz. 18½ dwt. per ton

Conclusions.—An inspection of the Golden Gate deposit forces on one's attention the great similarity between it and the Monte Christo in its irregular leaders and zone of altered country rock.

The amount of work done during the last three years is very disappointing, the time having been apparently spent in tracing each leader till the gold left it. To make the shafts and drives approximately 270 tons must have been broken down, and, adding 25 per cent. for stopings, the total quantity raised amounts to 350 tons for 86 oz. of gold, which is equal to 5 dwt. per ton. It would, therefore, at first sight, seem improbable that the reef would pay to work by any method involving the blocking out and breaking down of the whole reef, but it must be remembered that the yield would in all likelihood be considerably increased if the whole of the stone were put through. Further development is by this consideration rendered justifiable.

BIG HILL.*

The present holders have since my last visit opened a drive for 170 feet along the Victoria reef from the old workings to the main adit, and have sunk a 20-feet winze on the same reef, about 70 feet along the drive. The reef has not been broken down, but one or two drill holes were made in it, proving two feet of stone, and the drillings are said to have yielded ½-oz. prospects.

The Big Hill mill now comprises a 16-horsepower portable boiler, a Blake stonebreaker (twelve tons per hour capacity), a Thompson crusher (two tons an hour), and a Wilfley table (one ton an hour). The Thompson crusher has proved a failure, because of so many of the working parts being exposed to the intense cutting action of the sands produced; two-inch manganese steel pins carrying the rollers wear out within a week, as do also one-inch manganese steel carriers (tires).

It is rumoured that a new company has lately been floated in London.

AUSTRALIAN.*

This reef was discovered by Martindale, whose crushings from 1899 to 1903 amounted to—

184 tons for a yield of 325 oz. 14 dwt. 15 gr. = 1 oz. 15½ dwt. per ton.

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* See G.S.Q.P. No. 186.

Soon after Martindale's retirement from the claim it was abandoned, because of local impoverishment. It has now (in August, 1905) just been taken up again in a five-acre lease, and there is promise of its being worked on a more extensive scale than heretofore.

SAINT PATRICK.*

The *P.C.*—The St. Patrick is now an extended claim of 400 feet by 400 feet.

The intention of the claimholders to continue the sinking of the No. 5 shaft (Sutton's, 120 feet vertical), to cut the reef at 200 feet depth, has been hitherto frustrated by the serious illness of the manager (Mr. John Clare). Mr. Clare bases his belief in the future of the reef on the fact that a solid body of auriferous pyrite and quartz was coming in at the bottom of the main underlie (No. 4 shaft), when it had to be abandoned because of the large amount (500 gallons) of water met with. Mr. Clare's knowledge of the following crushings from the western end of the reef fortifies him in his faith:—

700 tons for 1 oz. 14 dwt. per ton during 1894-1898,
240 tons for 18 dwt. per ton during 1901-1903.

No. 1 West.—A shaft has been sunk 30 feet, and a drive opened for 30 feet to the south. This drive probably passed over the cap of the reef (pitching westwards), for it was first proved in a gully ½ chain to the east.

No. 1 North.—Since my last visit in 1903 a fourth shaft has been sunk, cutting the "North" reef at a depth of 55 feet. This was continued for 14 feet along the reef on nine inches of stone carrying 15 dwt. per ton. Further prospecting has been abandoned on it for the present, because the workings are almost at the boundary of the P.C., into which the reef dips.

GLADSTONE.*

During the last two years Mr. Kerridge has been receiving Government assistance in proving the Gladstone reef below the old workings. He has struck the reef at 120 feet depth, and reports it payable, but is unable to work it because of lack of capital. The mine has now (August, 1905) been idle for some weeks. Mr. Kerridge has given me the following particulars:—

The main vertical shaft is now 126 feet deep, and there is a 26-foot crosscut to the reef at a depth of 120 feet, with drives twelve feet east and three or four feet west on the reef.

The reef is from six inches to twelve inches thick. A crushing in the small three-head battery at the mine gave—

2 tons for 19 dwt. per ton;

but it is considered that half the gold contents were lost in treatment. The reef cut was believed to be only a branch from the main one, because of a split taking place on the bottom level in the underlie.

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* See G.S.Q.P. No. 186.

The continual pumping in the main vertical shaft drained the old workings, and before ceasing operations Mr. Kerridge continued the underlie whip shaft to 80 feet depth, and drove 37 feet east, striking good gold near a crosscourse. Several crushings were obtained, which were not altogether satisfactory because of the difficulty in effecting amalgamation.

GUIDING STAR.

LOCATION.

The Guiding Star reef crosses the main road within 30 chains of Thane's Creek, about 6½ miles west of Pratten. The eastern workings are now included in Costello's selection, the remainder being on the goldfield.

HISTORY.

Gold was first found in loose fragments of quartz in the soil about 1879 or 1880. Payable stone was from the first raised from the No. 1 West; while that in the P.C. was poor, and no other claims seem to have done any work to speak of at the time of the first rush. About 1895 two other shoots of gold were located to the west on the same reef. A shaft has also been sunk some chains to the east of the P.C., but without finding the reef. The whole line is now again deserted. None of the shafts are accessible, and, of course, little as to the nature of the reef can be seen at the surface.

COUNTRY.

The footwall is strongly defined, the country rock below water-level being a dark blue-black, shaly slate, which on the surface weathers light-brown, often with a light-blue interior. No stratification can be made out on the outcrop, though faces which may be joints or even laminations run north-westwards.

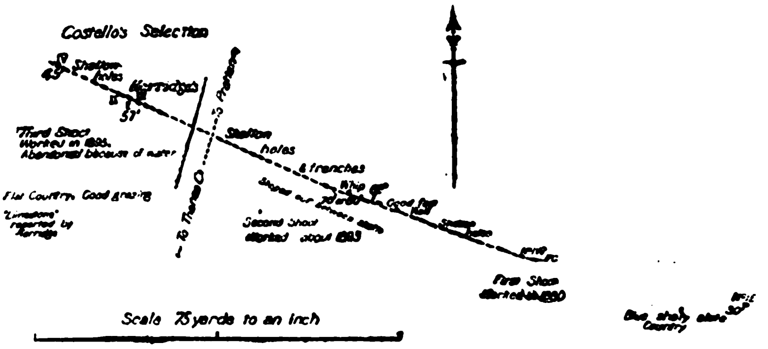


FIG. 2.—SKETCH PLAN OF WORKINGS ON GUIDING STAR.

REEF.

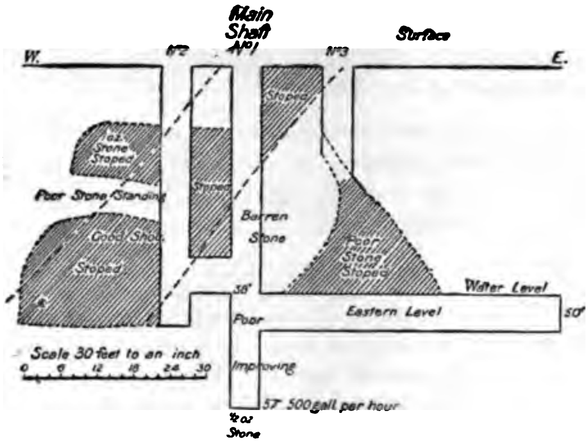
The reef, which has been worked over a distance of ten chains, has a general course of west 20 degrees north, its dip at the surface being 82 degrees to the north 20 degrees east, but it is more nearly vertical at a depth.

First Shoot.—In the No. 1 West (on which claim the discovery was made) the reef averaged 15 inches, and to a depth of 80 feet (10 feet below the water-level) it carried from 10 to 30 dwt. (averaging slightly under an ounce) per ton. The shoot pitched westwards.

In the P.C. shaft, ten feet east of the No. 1 West, the reef widened (to 18 inches at the surface, and to three feet at 36 feet depth), and at the same time the gold contents fell to 3 dwt. per ton, as proved in an eight-ton trial crushing. This shaft is on a slight bend towards the east, which is probably local, the continuation being in all likelihood towards the east-south-east. Owing to this bend, the quartz on the eastern end of the shaft is cracked and internally slickensided; elsewhere it is massive and irregularly laminated by blue seams, indicating it to be partly a replacement reef.

Second Shoot.—This lies about three chains west-north-west of the P.C. Four shafts—the deepest about 70 feet—have been sunk here, and the ground between them has been stoped out over a distance of a chain.

Third Shoot.—This is situated five chains beyond the second. Mr. Kerridge, who did most of the work on this shoot, has given me the accompanying section (Fig. 3), showing the extent of the stopes between his shafts Nos. 2 and 3. The main shaft is 57 feet deep, the water-level being at 38 feet depth. Mr. Kerridge reports that 20 inches of 1-oz. stone still remains on the 50-foot level in No. 2 shaft, and that the stone in the shaft, continuously improving, runs ½ oz. per ton in the bottom.



* 20-inch hard reef, with plumbago dig, and strong clean walls.

FIG. 3.—KERRIDGE'S WORKINGS ON GUIDING STAR.

Somewhat over 100 tons has been crushed, the last return being for 1 oz. per ton. It will be noticed that the shoot here also pitches westwards. It is understood that the mine was abandoned because of the water encountered (500 gallons per hour).

CONCLUSION.

The above information may be of use to anyone disposed to open up the reef and try it below water-level. With regard to the continuation of the reef eastwards from the P.C., I was informed by Mr. J. Clare, a miner experienced in these fields, and to whom I am indebted for much of the above information, that in prospecting for reefs he has generally found it safe to follow the direction of the overlooking ridge or spur. This agrees with the present trend of geological opinion. It has been shown that in the region north of the Yellowstone Park, in Montana, there is considerable agreement between faults and drainage lines* (and in consequence watersheds).

Mr. Clare spoke of a 2-foot barren reef about a quarter of a mile east of the Gladstone, and possibly a continuation of it, but there was not time for me to see it.

CULLAN'S TWINS.

This is a prospecting area (200 feet by 200 feet) located in a dense scrub on the Thane's Creek Goldfield, 4½ miles west of Thane, the present terminus of the Warwick-Goondiwindi Railway, and 24 miles from Warwick.

The whole of this country has been thoroughly prospected for alluvial, but, owing to its hitherto isolated position, little or no work has been done on the reefs, outcrops of which are reported every few chains to the south of Cullan's.

The discovery of auriferous quartz here was made in March, 1904, through numerous fragments of the stone having been brought to the surface of the soil by the roots of a gum-tree. Trenching in the neighbourhood has resulted in the discovery of three lines of reef.

NORTHERN REEF.

Reef.—The northern reef strikes west ten degrees north, and dips 86 degrees to south ten degrees west. It is massive and well defined; the footwall is slickensided, but the hanging-wall, though easily detached from the quartz, does not show signs of movement. The thickness of the reef varies between nine inches (near the surface) and two feet (in the lower workings), the changes being gradual.

The stone is bluish in colour, and has a glassy appearance; towards the hanging-wall it is to some extent laminated by thin inclusions of the country rock. Galena is said to have been seen in it, as also copper stains, of which, however, I saw none. The gold occurs mostly on yellow "faces" or joints in the quartz, which appear to have been lined with pyrite, deposited since the quartz. It is nearly all found within six inches of the hanging-wall, the quartz on the footwall being generally considered barren. No absolutely blank part of the reef has yet been found.

---

* A Fracture Valley System. Joseph P. Iddings, in Jour. of Geol., V. XIII., 1904.

The gold contents of the reef appear to have been favourably influenced by intersecting or branching leaders (without gold), which glance off to the east-north-east in the footwall, and to the west-south-west in the hanging-wall, as though following a set of parallel fractures. One exception to this rule is to be seen on the 15-foot level, where, at ten feet east of the shaft, the normal twelve-inch reef has increased to 20 inches. Just beyond that point a "horse" comes in, causing the splitting up of the reef into a number of barren leaders, which branch off into the footwall, the main part, six inches thick, continuing on the line of the reef. The reef at this point is not rich.

The country rock is a shaly slate, dipping about 45 degrees to the west 20 degrees south.

Workings.—The main shaft is 50 feet deep. At the bottom a level runs 20 feet to the west, and above it the reef has been, and is being, stoped to within ten feet of the surface on a main shoot pitching westwards, and reaching the surface for some yards west of the shaft. In the bottom level the reef—18 inches wide in the shaft—widens to two feet, but again contracts in the face to twelve inches. A small shoot, two feet in length, is known to occur in the sump. In the western drive on the 15-foot level the reef is only nine inches thick, and can be seen to be pinching upwards; in the eastern drive it opens up to 20 inches at ten feet from the shaft, where, as already explained, a number of leaders branch off, and the main reef is reduced to six inches in thickness.

Output (per Mr. Cullan)—

32½ tons for 31 oz. 16 dwt. = 19 dwt. 13 gr. per ton
48 „ 38 oz. 16 dwt. = 16 dwt. 4 gr. per ton
20 „ = 6 dwt. per ton.

This last crushing was a trial from all along the bottom, and the return is far too small to pay under the present conditions of working—*i.e.*, with one man below and one man on the brace.

Results.—In spite of the local impoverishment in the 50-foot level, the reef is well worthy of a thorough trial by continuation of the shaft to greater depths, but, unfortunately, the present holders have not sufficient resources to undertake this expense. The work done, though inconsiderable, is sufficient to illustrate the permanency and promise of the reef.

MIDDLE REEF.

Reef.—The middle reef lies 35 yards south of the northern, to which it is parallel. The outcrop exposed in a trench is from two feet to two feet six inches wide.

Stone.—The quartz is bluish and glassy in appearance, the gold being contained in nine inches of its thickness. The richest stone was found at a small bend and break in the reef. The gold has been traced on the surface over a distance of 100 yards.

Workings.—The workings (now flooded) comprise two 14-foot shafts within a few feet of one another, and lying south 30 degrees east of the main shaft on the northern reef, and two trenches, three or four yards in length.

Output.—A trial crushing, from the whole width of the reef exposed in the trenches, of—

24 tons yielded 4½ dwt. per ton.

This is too small to pay expenses (with cartage 6s., and battery treatment 11s. 6d. per ton). Several tons of stone from the shafts now lie at grass.

SOUTHERN REEF.

Reef.—The workings on this reef lie 67 yards south 14 degrees east of those on the middle reef. The reef runs west 22 degrees north, and is practically vertical. Where now exposed, it is about six inches thick. It appears to be pinching towards the west, and may have been thicker in the stoped portion. It is well defined, being on a strong fissure, the hanging-wall having slickensides and corrugations inclined 45 degrees to the west. The main shoot of gold worked for about 35 feet from the surface was found to follow one of these corrugations, as well as a cross leader dipping about 45 degrees to the north-west.

The country rock adjacent to the stopes is sandy, but the same blue slate as near the northern reef is found west of the stopes.

Workings.—The workings comprise two shafts 20 feet apart, the eastern 25 feet, and the western 35 feet, deep. The reef has been stoped out between them and for a few feet on each side, but in the faces and floor is believed to be too poor to exploit.

The reef is worthy of further prospecting by sinking.

Output.—A few tons only have been taken from here, and they are included in the crushings given above.

Brisbane, 4th September, 1905.

By Authority: GEORGE ARTHUR VAUGHAN, Government Printer, William street, Brisbane.

Queensland.

DEPARTMENT OF MINES.

Queensland Geological Survey.
(B. DUNSTAN, ACTING GOVERNMENT GEOLOGIST.)
PUBLICATION No. 207.

SOME MINES

IN THE

BURNETT DISTRICT

(WEST OF MARYBOROUGH).

WITH TWO PLANS.

By B. DUNSTAN, F.G.S.,
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BRISBANE:
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SOME MINES IN THE BURNETT DISTRICT.

◆

1. CALGOA COPPER MINES, NEAR KILKIVAN.

The Calgoa Copper Mines are situated about fifteen miles north of Kilkivan, and about the same distance north-east of Boowoogum, stations on the Maryborough-Kilkivan Railway line. The workings are on Thunder Creek, one of the heads of Calgoa Creek, the latter joining Munna Creek, a tributary of the Mary River. The mines examined are on the Lug-e-nor Block (No. 1415), the Knight of Gwyn Block (No. 1419), and the Mayflower and Eastern Mayflower claims.

On Thunder Creek the copper occurs on the surface as blue and green carbonates, and as black and red oxides, mixed with red and brown oxides of iron, while some distance below the surface the copper occurs as yellow sulphide mixed with iron pyrites. There are about eight well-defined lodes containing copper, some of which have been worked, while, in addition, there is a very irregular formation which contains copper in more or less payable quantities wherever tunnels have been driven into it. The lodes appear to be confined to a belt of country, which, with the adjoining country, is composed of syenitic granite, and acidic dyke rocks traverse the belt and the country outside in all directions.

The workings consist of a number of shafts and drives, which are confined, principally, to the Lug-e-nor and Knight of Gwyn Blocks, the positions of which are shown on the accompanying sketch plan. No. 1 Tunnel, on the Lug-e-nor Block, was opened many years ago, and has penetrated an irregular formation, small veins of copper pyrites showing in numerous places throughout its length. Occasionally the copper is found in large masses, and one of these, now being worked, has produced over 75 tons of copper ore up to the present time, averaging 18½ per cent. of copper, and having a gross value of £1,300 (*vide* "Returns of Copper Ore received at Waratah, N.S.W.," furnished by Messrs. Turner Bros.).

SOME RETURNS OF COPPER ORE, CALGOA MINES.

(From Waratah, N.S.W.)

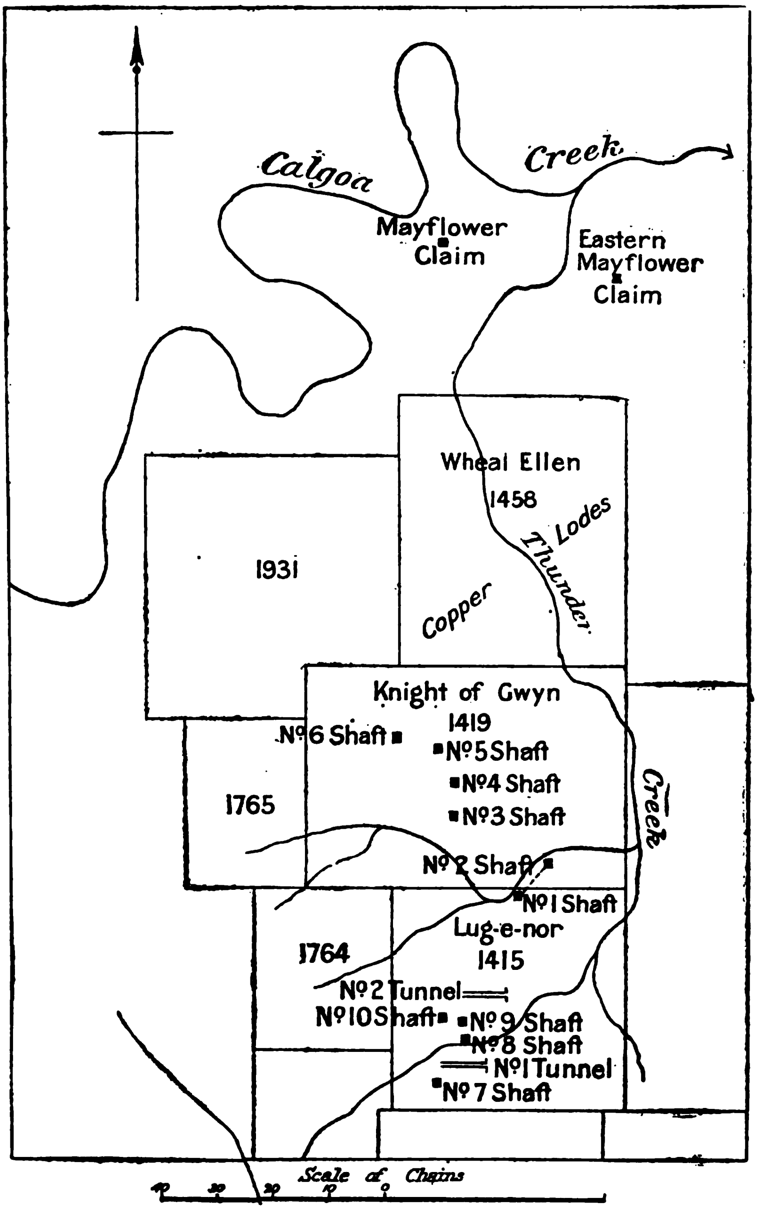
Locality.	Gross Weight.			Assay. Per cent.	Gross Value.			Net Return.			Date.
	T.	C.	Q.		£	s.	d.	£	s.	d.	
Top Tunnel, No. 1 ...	10	4	2	19	141	0	5	116	8	5	15 Nov., 1905
" " ...	1	3	0	21¾	17	19	6	15	5	0	17 Nov., 1905
" " ...	11	1	0	21½	181	15	11	152	12	2	30 Nov., 1905
" " ...	12	15	2	20⅝	199	17	8	169	7	2	17 Jan., 1906
" " ...	8	11	0	17¾	112	1	6	91	14	5	23 Jan., 1906
" " ...	10	10	0	13⅛	102	18	9	77	16	0	8 Feb., 1906
" " ...	8	12	0	16¾	105	19	10	85	2	6	14 Feb., 1906
" " ...	8	3	2	17⅛	105	18	10	86	8	5	7 Mar., 1906
" " ...	5	8	0	21	84	17	0	74	12	0	9 Dec., 1906
No. 2 Tunnel	9	5	0	19¾	119	0	2	96	11	9	26 Sept., 1905
"	4	14	0	13	42	4	9	32	3	3	8 Nov., 1905
"	10	6	0	22	168	10	7	144	0	8	7 Dec., 1905
"	13	11	0	9¼	88	2	3	56	1	8	3 Feb., 1906
No. 6 Shaft (Knight of Glynn)	3	0	0	24½	53	16	4	73	3	5	17 Jan., 1906
	3	8	2	14	34	13	6				
No. 1 (boundary) Shaft	5	10	0	23⅞	96	16	7	82	11	9	8 April, 1905
" " "	17	16	2	21¼	252	7	3	238	12	5	30 Nov., 1905
" " "	10	7	2	26¾	203	15	0	173	1	8	15 Jan., 1906
Calgoa P.C.	2	8	0	26⅝	45	18	1	40	3	0	8 Feb., 1906

No. 2 Tunnel, also on Lug-e-nor Block, has been driven fifty-six feet on a small vertical vein of copper ore, and has produced over thirty-seven tons of ore, averaging seventeen per cent. of copper, and having a gross value of over £417.

No. 1 Shaft, on Lug-e-nor Block, has been sunk to a depth of 100 feet. The lode, which the shaft follows on the underlie, varies up to eight feet in thickness, averages six feet between defined walls, and contains, sometimes, a thickness of one foot of good copper ore. The strike of the lode is E.N.E., the underlie being at angles varying from 45° to 30° from the vertical, the direction of dip being towards the south. Recent returns show that over thirty tons of ore have been raised, yielding, on an average, 23 per cent. of copper, and having a gross value of over £550.

No. 2 Shaft, on the southern boundary of the Knight of Gwyn, has been sunk forty-six feet on the underlie, and has exposed at the bottom about six feet of formation carrying iron pyrites, with small quantities of black oxide of copper and grey copper ore. Kaolin is present on one of the walls of the lode, and is probably a decomposed dyke rock. The lode in this shaft is evidently a continuation of that in No. 1 Shaft, and many features indicate that deeper sinking will probably result in copper being found in payable quantities.

PLAN OF CALGOA COPPER MINES



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No. 3 Shaft, on the Knight of Gwyn Block, and about twenty ains north of No. 1 Shaft, is thirty-six feet deep, having an underlie the south-east at an angle of about 20° from the vertical.

No. 4 Shaft, about six chains north of No. 5 Shaft, is forty-two t deep. The lode strikes north-east and is nearly vertical, slightly lining to the south-east. Between the walls there is a formation feet thick, and in the form of carbonates, red oxide, and yellow phide, copper is present in traces. The sulphide at forty-two feet is ginning to show more abundantly, and a few feet further sinking ght reveal payable ore.

No. 5 Shaft is north-north-west from No. 4 Shaft, and is thirty t deep. The lode strikes north-east, and underlies from the vertical an angle varying from 45° to 30° to the south-east. It is about ur feet thick, and on the surface is seen to be an ironstone formation thout traces of copper, but the sinking has revealed copper ore, hough not yet in quantity.

No. 6 Shaft is situated to the west of No. 5 Shaft, and has been k to a depth of seventy feet. The lode strikes north-east, and is ical, and was worked in places to a depth of thirty-eight feet many s ago. At the bottom a drive has been put in along the lode for stance of thirty-five feet, and in the face of the drive ten inches of er ore in a formation four feet wide has been exposed. This shaft not be inspected, and the information concerning it has been lied by the owners (Messrs. Turner Bros.). Recently six and tons of ore, averaging nineteen per cent. of copper and having s value of £88, was taken out of this shaft, but there is no record ng what was done when these mines were worked thirty-four ago. Several old shallow workings exist close to the shaft, and the evidence of the refuse heaps many tons of rich ore must have removed.

No. 7 Shaft is located on the hill west-south-west from No. 1 el, and has been sunk to a depth of 110 feet. There is no defined n these workings, but the copper occurs in a formation, which bly is a continuation of that penetrated by No. 1 Tunnel, and it resembles in many respects. Both in No. 1 Tunnel and in Shaft there is evidence of the existence of a large body of ore ning copper, which, however, might not pay to send away from ines for treatment, but which would be a valuable asset if ng works were established in the locality.

No. 8 Shaft, which was opened years ago, at about the same time . 6 Shaft, is situated about ten chains to the north of No. 1 el. It is ninety feet deep, and underlies from the vertical to the —east at an angle of about 30°. The lode in the shaft strikes —east, and consists of about five feet of formation, which in places is quite barren of copper, but is sometimes composed almost entirely of copper pyrites and iron pyrites. The formation is principally made up of masses of granite, quartz, and a reddish felspar, and has a uniform dip to the south-east. There are two levels at ninety feet, one driven fifty feet to the south-west, the other thirty feet to the north-east, copper pyrites showing in both levels. The ore below ninety feet is said to pinch out to a few inches in thickness, but there is evidently a lot of mineral in the portion of the lode to the south-west.

No. 9 Shaft is about five chains from No. 8 Shaft, and is forty-five feet in depth. Hundreds of tons of ore have been taken out of this shaft, the higher grades of which have been picked out and sent away to smelters. That which is left on the surface is very suitable for machine concentration.

No. 10 Shaft is close to No. 9 Shaft, and is 105 feet deep. There are at grass 200 tons of ore, which contain about three per cent. of copper. The ore originally contained six per cent. of copper, three per cent. of which has been picked out and sent away to smelting works.

Two other copper mines were also inspected—namely, the Mayflower and the Eastern Mayflower. The Mayflower claim is on the northern side of Wheal Ellen Block (1458) and 300 feet north from the boundary of this block a shaft has been sunk to a depth of forty feet. The lode in this shaft strikes east and west, has a nearly vertical dip (6 in 1) to the south, is only a few inches thick, consists of copper carbonates, iron and copper pyrites and black oxide of copper, and has well-defined walls of syenitic granite. At thirty feet a level has been driven to the west for twelve feet, and another to the south for ten feet, in each of which the lode is a few inches thick. Five tons of ore has been taken away for treatment, and is said to have yielded twenty per cent. of copper. Other lodes are exposed on this claim, but, except for a little surface work, and an old shaft which has been sunk to a depth of eighteen feet, they have not been prospected, although of a promising character.

The Eastern Mayflower claim is due east of the Mayflower, and is on the opposite (eastern) side of Thunder Creek (*see* Plan). The lodes trend east and west, and underlie to the south at an angle of about 80°. One shaft, eighteen feet deep, has been sunk on a copper-bearing formation two feet thick, but at a depth of sixteen feet the formation pinched or cut out, and at the bottom there are no traces of copper to be seen.

Besides the quantities of ore which have been recorded from the various workings, there are many tons of good ore ready to be bagged or are bagged ready for transit, in addition to which there are consignments now in transit to the smelting works.

The inspection of these mines were hurriedly made, but the conclusions drawn therefrom show that the mines are in active development, and that they give promise of yielding a large quantity of copper ore in the future.

2. AUBURN FALLS GOLD MINE.

This mine is situated five miles easterly from Glenwood Station, and close to the junction of Cadarga Creek and the Auburn River. Previously an inspection of this mine and those in the vicinity was made by Mr. Ball,* who saw them when they were all being worked. Recently the mine known as the Auburn Falls Gold Mine has again started active operations, and a new shaft (called No. 2) has proved the continuation of the lode (or lodes) in depth.

The outcrops on the surface show that there is a parallel series of lodes striking, approximately, north-west and south-east, and varying much in thickness and inclination.

The shaft known as No. 1 Shaft is sunk to a depth of thirty feet on a lode containing quartz and mispickel, and at the bottom of the shaft a drive has been put in along the lode to the north-west for a distance of twenty feet. The thickness of the lode varies considerably, but in the drive averages about one foot, with a tendency to increase in size below. A sample of stone taken from all the exposed portions of the lode in this drive gave, on assay, one ounce of gold and seventeen dwt. of silver to the ton.

No. 2 Shaft, about 100 yards to the north-east of No. 1 Shaft, has been sunk vertically to a depth of 120 feet, the bottom twenty feet of which underlies slightly to the south-west. The lode here is very similar to that in the No. 1 Shaft, in containing a large quantity of mispickel (arsenical pyrites), while in a crosscut at 100 feet veins of this mineral, sometimes a foot wide, alternate with bands of quartz and of granite, making up a lode formation several feet thick. At the bottom of the shaft the hanging-wall of the lode has not been penetrated, but the mineral is showing very freely in the stone exposed. From this place five cwt. of stone was taken out as a bulk sample, and the assay of a small average sample from this yielded fourteen dwt. of gold and six dwt. of silver.

Trenches have been made across the mineral belt between the two shafts, and several lode formations have been exposed, but, beyond showing their thickness, no work has been done on them.

An inspection was made of Vant's claim, about a quarter of a mile south of the Auburn Falls Mine, now abandoned, and a sample taken from the stone at grass gave two dwt. of gold and four dwt. of silver. At Doherty's claim (also abandoned), about 300 yards east of Vant's claim, a lode one foot thick is exposed, and seems to be a continuation of one of the lodes in the Auburn Falls Mine. A sample of the stone from this claim yielded at the rate of seven dwt. of gold and eight dwt. of silver to the ton.

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* Cadarga Creek Mines, Gayndah District, by L.C.B. Queensland Gov. Min. Jour. Ap. 14, 1904 (Vol. 5, pp. 162-3).

The result of the assays made from the samples of stone from the Auburn Falls Mine are very encouraging, but on account of the presence of so much arsenical pyrites in the lode, it would be advisable to have a bulk sample tested, in order that an opinion may be formed as to the best method of treatment, before any expense is incurred in erecting machinery.

3. DYKEHEAD GOLD MINES.

These mines are situated about eleven miles from Dykehead Station, on Deloura Creek, a branch of the Auburn River, being distant about sixty miles westerly from Gayndah. The country is granite throughout, and near the mines there are masses of kaolin, evidently being decomposed intrusive dykes. The reefs are numerous and very well defined, but at the present time the only work being carried on is that at the mine known as the Dykehead.

On this mine a shaft was sunk some years ago to a depth of 80 feet. This has been cleaned out recently, and the old workings on the reef at a depth of 65 feet below the surface have been re-timbered. This reef has a thickness of about three and a-half feet, and from the small portion exposed it appears to be vertical. The stone tested recently from this reef is said to have yielded four and a-half dwt. of gold to the ton, but the surface stone, when treated some years ago in a battery, is said to have yielded over one ounce of gold to the ton. At the time of the recent examination this reef was not being worked, attention being confined to a second reef picked up in the old workings.

This second reef is about thirty feet south-westerly from the other reef, and is reached by a crosscut ten feet away from the shaft. It strikes north-west and south-east, and is about four feet thick. A trial is now being made of the stone.

Water is troublesome in the mine, and, as one of the walls is of kaolin, close timbering is imperative in keeping the workings from falling in.

The field is worth further prospecting, and, even if the present trial operations result in failure, there is sufficient inducement to warrant the expenditure of capital in opening other reefs on the field.

4. BURNETT SQUATTER REEF, ST. JOHN'S CREEK.

Many years ago the reefs in this locality were being worked very extensively for gold, and recently operations have been started to open up, afresh, the reef known as the Burnett Squatter. From Eidsvold, St. John's Creek is situated to the south-west about sixteen miles distant, and the Burnett Squatter Reef is about half a mile south-west from the village on the bank of St. John's Creek.

The reef averages about eighteen inches in thickness, and is very persistent in its occurrence along the surface for over 400 yards. The strike of the outcrop is east and west, the dip being to the south, with an underlie of 30° from the vertical.

This line of reef was opened several years ago, and when all the free-milling stone above the water level had been taken out, a prospecting shaft was sunk to a depth of 105 feet, but the reef was abandoned. Work is now in progress, and another shaft is being sunk in close proximity to the old one, it being considered that the reef would be found sufficiently rich to be payable with modern methods of treatment. Recent developments have not been advanced sufficiently to warrant an expression of opinion concerning their prospects. The yields of gold from the mines on this reef, taken from the annual reports of the Mines Department, are as follows:—

BURNETT SQUATTER REEF, GOLD RETURNS.

Year.	Tons Treated.	Gold Yield.		
		Oz.	dwt.	gr.
1888	9		...	
1889	283	130	5	12
1890	63	23	0	18
1891	8	3	10	0

The Springs Gold Lead, on St. John's Creek, was also visited, but the place was found to be uninhabited, and the mines were idle.

5. DON JON BISMUTH MINE, DEGILBO DISTRICT.

This mine was worked years ago for bismuth and for iron, and, after being idle for many years, has quite recently been prospected for bismuth, gold, and copper.

The mine is situated about a quarter of a mile south of Mount Havilah, being distant one mile north of the Biggenden Bismuth Mine, and, in a direct line, about three miles south-south-westerly from Degilbo.

A report on the district was written by Mr. Ball in 1902[*], who gives an account of the mine operations up to that time.

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[*] Mount Biggenden Gold and Bismuth Mine, and the Paradise Goldfield. By L.C.B. Brisb.: By Auth., 1902. Pp. 6. pl. 12, maps 2. (G.S.Q.P., No. 173.)

The present operations are confined to an old shaft, which, on being cleaned out, was found to have on one of its sides a lode, or formation, containing very rich bismuth sulphide ore (bismuthinite), an average sample of which yielded thirty per cent. of bismuth and fifteen dwt. of gold to the ton. Further developments at forty feet below the surface exposed a lode containing copper pyrites, iron pyrites, and arsenical pyrites with bismuthinite and native bismuth, but the assays of the stone failed to show more than two dwt. of gold and two ounces of silver to the ton, with 2½ per cent. of copper and 4½ per cent. of bismuth. Work is now proceeding with the object of exposing more bismuth ore, and to see if better prospects can be obtained in other parts of what is undoubtedly a lode several feet in thickness.

6. UNITED REEFS, KILKIVAN.

A casual visit was paid to the United Reefs, being worked for copper and gold, at Black Snake, in the Kilkivan district, but the mine was found to be in the same condition as when Mr. Rands inspected it in 1886.* From the old workings, some ore has been removed, which, it is said, has given satisfactory returns at the smelting works at the mine, and everything is being put in order with a view of working the mine in a thoroughly systematic manner.

7. COMMONWEALTH COPPER MINE, DEGILBO.

The Commonwealth Copper Mine is situated on the north-west side of Mount Havilah, and is about two miles and a-half to the south-south-west of Degilbo Railway Station, on the Maryborough-Gayndah Railway line. The country in the vicinity of the mines is made up of granite and slate, the copper lodes being a contact deposit between the two formations. To the north of the mine the lode evidently follows this line of contact, but to the south the country is somewhat disturbed, and the continuation of the lode cannot be traced.

The lode trends nearly north and south, the underlie being to the east at an angle of 20° from the vertical. The thickness varies in different parts of the lode, the extreme southern workings showing six feet of ore, whilst in the northern workings the lode is about three feet thick, other intermediate parts varying between one and three feet. Taking the whole of the length of workings, a distance of about 120 feet, the lode would certainly average over two feet in thickness.

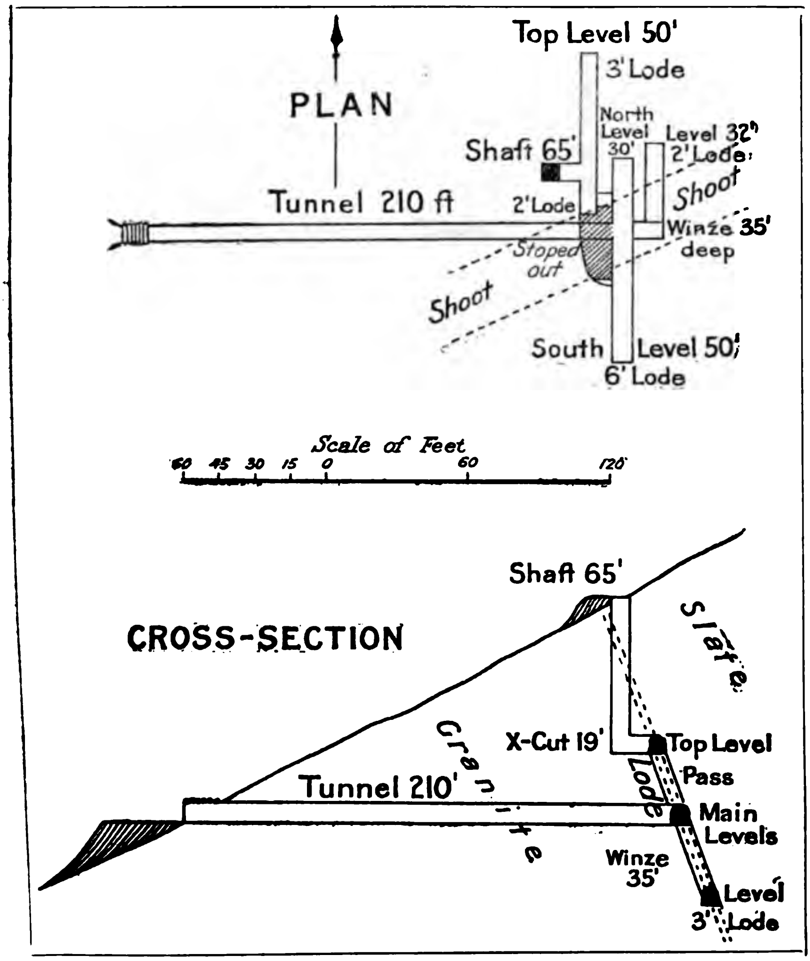
The principal lode mineral is arsenical pyrites (mispickel), this occurring throughout the mine, and with this there is red and black oxide of copper (cuprite and tenorite), green carbonate (malachite), yellow sulphide (copper pyrites), iron pyrites, bismuth sulphide (bismuthinite), earthy hematite, and carbonate of lime. The latter

---

* Geology and Mineral Resources of Kilkivan and Black Snake. By W. H. Rands. Q.G.S.P., No. 28.

COMMONWEALTH COPPER MINE

PLAN AND SECTION OF WORKINGS.



mineral, mixed with clay, occurs in every part of the mine in small quantities, either in the lode or between the lode and the walls, but quartz is found only in traces.

Some portions of the lode are richer than others, and from an examination of the workings, there appears to be a shoot of richer ore dipping to the north-east, while on either side of this shoot, both to the north and south, the ore is comparatively poor.

For the purpose of working the ore, a tunnel, 210 feet long, has been driven into the face of the hill, through granite, meeting the lode on the footwall. From the end of this tunnel a level has been driven thirty feet to the north along the lode, which averages eighteen inches thick. A sample stripped from the exposed portions of the lode on the roof of the level and from the face yielded on assay the following results:—

Gold	0 oz. 0 dwt. 14 gr. per ton.
Silver	5 oz. 16 dwt. 0 gr. per ton.
Copper	1·7 per cent.

The manager of the mine, while considering the sampling would indicate the actual value of the ore taken out from the whole of the lode without including any worthless stone, suggested sampling with a view of showing the value, not of the lode as a whole, but the value of the ore as it would be taken out for treatment, this being the usual practice at the mine. A sample thus prepared by the manager, representing about twenty per cent. of the whole of the stone which would have to be removed in working out the lode, gave the following results on assay:—

Gold	Trace
Silver	17 oz. 17 dwt. per ton
Copper	6·8 per cent.

At the end of the tunnel a level has been driven to the south for a distance of fifty feet, and in this the lode is six feet wide in places, but the ore is poor in quality. On the top of this level the lode becomes smaller and richer, and thirty-three tons of ore have been taken out and sent away to America for treatment. A sample taken from all exposed places along this stope assayed as follows:—

Gold	0 oz. 0 dwt. 14 gr. per ton
Silver	4 oz. 16 dwt. 0 gr. per ton
Copper	1·6 per cent.

The thirty-three tons for treatment was sent to the Tacoma Smelting Company's Works, Washington, U.S.A., and the results furnished by this company show a gross value in gold, silver, and copper of about £5 per ton, the assays furnished showing the following results:—

Gold	0 oz. 1 dwt. 0 gr. per ton
Silver	16 oz. 0 dwt. 0 gr. per ton
Copper	3·5 per cent.
Silica	43·6 per cent.
Iron	18·6 per cent.

This stope above the south level is on the shoot of ore previously referred to, and is shown on the accompanying plan.

At the end of the main tunnel, a winze has been sunk to a depth of thirty feet on the underlie of the lode, and at the bottom a level has been driven thirty-two feet to the north, across the shoot of ore. The lode exposed in this level averages about one foot ten inches in width, and a sample stripped from the top of the level, along a distance of twenty-five feet, gave the following return:—

Gold	0 oz. 0 dwt. 14 gr. per ton
Silver	5 oz. 8 dwt. 0 gr. per ton
Copper	1·2 per cent.

The manager's samples, five in number, from this level and from the bottom of the winze, returned the following assay results:—

	Gold.				Silver.				Copper.
	Oz.	dwt.	gr.	per ton.	Oz.	dwt.	gr.	per ton.	Per cent.
1	Trace				44	16	0	,,	11·4
2	0	0	19	,,	21	18	0	,,	3·3
3	0	0	15	,,	30	9	0	,,	2·5
4	0	1	13	,,	4	10	0	,,	0·6
5	0	2	19	,,	2	2	0	,,	0·7

Nos. 1, 2, and 3 were taken from the top of the level, No. 4 was from the face of the level, and No. 5 (iron pyrites only) from the bottom of winze and mouth of level.

Close to the tunnel a shaft has been sunk from the surface to a depth of sixty-five feet, crossing the lode at about twenty feet. From the bottom a crosscut was driven to meet the lode on the footwall side (*see* cross-section, attached plan). A level driven north from the shaft has opened up the lode in this part of the ground, proving it to be three feet thick, but very poor in quality.

There is no doubt that the low metal values offer but little encouragement for further development, but at the time of the inspection the mine presented a most unfavourable appearance, as all the rich stone available from the shoot had been sent away for testing purposes. Possibly further prospecting either in depth or along the levels might reveal ore of a richer quality, although such prospecting would be purely speculative.

Taking the average in values and quantities throughout the mine, it may fairly be estimated that a large number of tons of ore could be taken out at a low cost, and would have approximately the following composition:—

Gold	½ dwt. per ton
Silver	12 oz. per ton
Copper	4 per cent.
Bismuth	2½ per cent.
Silica	40 per cent.
Iron	20 per cent.

This would have a gross metal value of, roughly, about £5 per ton, and would represent about twenty-five per cent. of all the stone taken out of the mine.

The method of treatment would require some consideration if the bismuth is to be saved as a product, and with the object of determining what effect concentration would have in enriching the metal contents, a sample of ore weighing about fifteen hundredweights was sent in 1903 to the Krupp Works in Germany for treatment. The assay of the parcel of ore gave the following result, according to the certificate furnished:—

Copper	6·12 per cent.
Bismuth	3·33 per cent.
Silver	16 oz. per ton.

The stone was crushed and dressed, and the report on the trial showed that it is possible to make a fine concentrate high in bismuth and silver and low in copper, whilst a coarser concentrate would be low in bismuth and high in copper. The fine concentrate (< 100 m.m.) was found to contain from 60 to 70 per cent. of the bismuth contents, and from 40 to 50 per cent. of silver contents, whilst the coarse concentrate (> 100 m.m.) contained from 40 to 50 per cent. of the copper contents and low in bismuth and silver.

By Authority: George Arthur Vaughan, Government Printer, William street, Brisbane.

Queensland.

DEPARTMENT OF MINES.

Queensland Geological Survey.

(B. DUNSTAN, ACTING GOVERNMENT GEOLOGIST.)

PUBLICATION No. 208.

REPORT

ON THE

NORTON GOLDFIELD.

WITH ONE MAP AND FOUR PLATES.

By LIONEL C. BALL, B.E.,
ASSISTANT GOVERNMENT GEOLOGIST.

BRISBANE:
BY AUTHORITY: GEORGE ARTHUR VAUGHAN, GOVERNMENT PRINTER, WILLIAM STREET.

1906.

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[Tadman, photo.

VIEW OF NORTON, GLADSTONE DISTRICT.

LOOKING EAST, FROM THE MINES.

REPORT ON THE NORTON GOLDFIELD.

INTRODUCTION.

Norton (or Milton) Goldfield is rectangular in shape, its length east and west being six and a-half miles, and its width north and south four miles. The watershed of the Many Peaks Range forms the eastern boundary; the surveyed boundaries of grazing selections 14v and 15v, Pemberton, the northern; of selection 17v, and portions 291 and 1, Pemberton, the western; and of 1v and 12v, Milton, the southern.

The field is located on the head of the Eastern Boyne River, and is also watered by Norton Creek, in the vicinity of which are the most important workings. Norton township, near the centre of the field, lies eleven miles west-south-west of Bororen Railway Station, on the North Coast line, and twelve miles west of Miriam Vale Station, on the same line. The township is connected by road with Gladstone, the distance to which is 44 miles. A road has also been opened over the Many Peaks Range to Bororen, but, there being excessively steep gradients on both sides of the range, it has been allowed to fall into a state of complete disrepair, and is now only passable for pack horses. An alternative route *viâ* the Eastern Boyne has been proposed, to escape these gradients, but the distance to the railway will be increased by perhaps ten miles.

This report has been prepared in response to a request made by the local progress committee some two years ago, when many of the mines were in full swing, and when it was believed the publication of the results of an examination of the reefs would be for the benefit of the whole field. Other work prevented my visiting the locality until early in this year, when the field was, unfortunately, going through a period of acute depression. Most of the workings had been abandoned, and were inaccessible, rendering it unnecessary for me to spend more than a few days in examination, especially as the field was geologically surveyed by Mr. Rands in 1885.* Much information was given me by Mr. Carmichael, and every assistance was offered by the few miners still on the field. The returns as to the yearly output have been taken from the Warden's annual reports.

HISTORY.

The first recorded discovery of gold on Norton Creek was made by two brothers named Lett, in 1871, but no records are available as to the progress of the field during the following seven years.

---

* **G.S.Q. Publication** No. 21. By William H. Rands, Assistant Government **Geologist.**

In 1878 there were 60 miners on the Norton Goldfield, and two 3-head stamper batteries were running. In the following year many of the mines reached mundic, and there was an appreciable falling off in the yield (the gold also becoming poorer).

In 1880 the miners numbered 50. It was becoming known that numerous reefs were payable (above the mundic).

During the following three years the population seems to have continuously fallen off, owing to the absence of any treatment works, but in 1884 the Frampton United Company was formed to attempt chlorination (the only other mine then working being the Advance). The company, after two years' profitable battery treatment of their surface stone, began chlorinating in 1887, the five roasting furnaces having cost £3,000. The Advance Company, after sinking to 400 ft., also erected roasting and chlorination plant in 1889, but these seem to have failed, for they were abandoned in 1890. In the same year, when the population had reached 200, the Frampton United, for no given cause, proposed to cease work, and in 1891 their property passed into the hands of the Conran Gold Mining Company. A decline, however, seems to have set in, for in 1893 very little work was done beyond collecting surface stone, and in 1895 reefing was in abeyance. Mr. Carmichael in that year erected a small chlorination plant, but as there are no returns, it was presumably ineffectual. The population had by that time dwindled almost to vanishing point.

In 1899, renewed interest was taken in the field, owing to the erection of a waterjacket blast furnace by Mr. Carmichael. This furnace has not been run by a metallurgist, and has consequently given unsatisfactory results. Two leases were applied for, but no work was done, it is understood, till 1902, a road over the range to Bororen, on the North Coast Railway having been opened with Government assistance in the previous year.

The Marodian Gold Mining Company took up a 40-acre lease in 1903, and during the following year expended £2,800 in crosscutting, driving, &c. Owing, however, it is understood, to speculations elsewhere, the company was compelled to cease operations and seek exemption. The population, which had during 1904 increased to something like 450, at once began to diminish, and there were not more than 50 on the field at the beginning of 1906.

At that time three leases (Carmichael's "Frampton" M. L. 79, Osborne's "Little Wonder" G. M. L. 130, and Osborne's "Bald Hill" M. L. 111) were in force, with seven extended claims ("Goody's," "Brigham Young," Booth's, Morrison's, Macdonnell's, "Sulphide," and "Paddock"). The only mine actually being worked was Morrison's, though there was a man each on the "Frampton," "Brigham Young," Booth's, and Macdonnell's.

GEOLOGY.

THE GRANITE.

The Norton Goldfield is located on the western edge of the Miriam Vale granite area, which covers about 1,000 square miles. This granite has been proved by Mr. Rands to be intrusive into the metamorphosed sediments, which form the hills south and west of Norton. It has not been shown yet whether the Norton granite is of the same age as the rest of the Miriam Vale area, but considerable variations in character are known in different parts, which it may not be possible to explain by differentiation in a single magma. Well-marked changes can be observed in crossing the Many Peaks Range from Bororen Railway Station—both coarsely granular biotite granite and very fine-grained hornblendic granite, which in parts would be termed a syenite, being seen. At Norton the granite is a typical fine-grained biotite variety. These remarks are made on the evidence of a macroscopic examination only, this department being without the services of a microscope section cutter.

The Norton area has suffered considerably from tectonic earth movements, which have developed several well-marked sets of joints. The forces causing the movements have not produced extensive single fissures, but instead the rock mass has been blocked out by joints, grouped at a definite angle to the direction in which the forces acted. The grouping may be recognised on reference to the attached map, one set of joints striking west-north-west, another north-west, and a third west (approximately). The joints are most irregularly spaced, being a quarter of a mile apart in one place, while in another a number may occur only a few inches apart. (*See* the "Sailor Boy.")

The joints have afforded passage for circulating solutions from which the metallic minerals have been deposited. Further, being lines of weakness, they have been followed by intrusive magmas forming dykes. The field is thus one immense regular stockwork, and all the joints may have been in direct connection at the time when the ores were deposited.

THE ORE BODIES.

With regard to the reefs, in one or two cases (Chandler's, &c.) central fissures were observed, but in no case were seen the smooth, slickensided walls due to a great fissuring. Some of the leaders (Carmichael's Gully, &c.) have well-defined walls and secondary gangue minerals only, but the great majority of the ore bodies are compound veins or "formations" consisting of altered (quartz, pyrophyllite, and sericite) granite, veined and impregnated by secondary minerals. In these cases there would appear to have been a tearing asunder of the walls of the joint, leaving flakes of the rock imperfectly attached to either side. Infiltrating solutions would reach these weaker spots, and deposition would there take place, as well as in the more open portions of the joints.

The granite exposed to the action of the solutions has undergone sericitisation (?). The quartz may be unaltered, and the micas can sometimes still be distinguished by their form and cleavage, but the felspars have been completely altered into granular yellow pyrophyllite (?) (Al_2O_3. $4SiO_2.H_2O$).

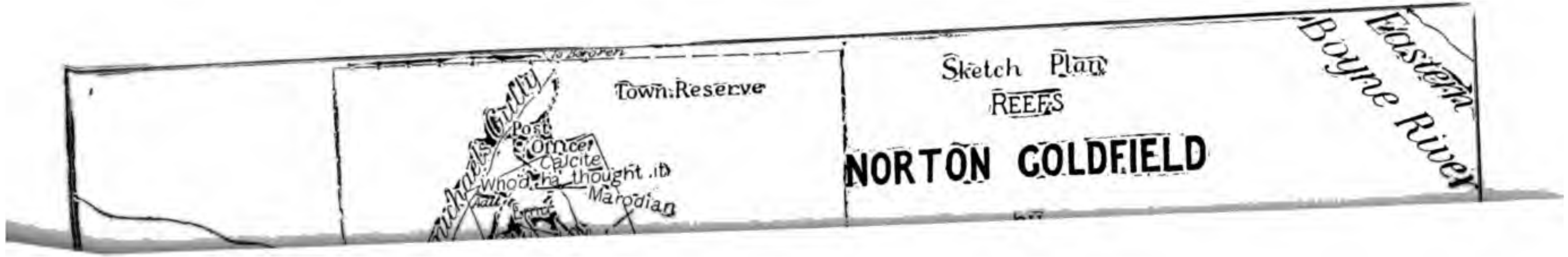
Mr. Rands distinguished between the reefs north and south of Norton Creek, finding those on the south to contain, with one exception (the All Nations), little or no calcareous matter in the gangue. and as early as 1880 it was reported that more free gold could be got from the mundic (to a depth of 200 ft.) in those reefs on the north side than from those on the south, where mundic was reached at between 30 and 40 ft. from the surface. Since then it has been repeatedly stated that the ores north and south of the creek are radically different. This, however, is not the case, for mispickel, pyrite, quartz, blende, chalcopyrite, grey-ore, galena, and calcite go to make up ore bodies on both parts of the field. One or other mineral may, however, be abnormally abundant or altogether absent from any particular reef or portion of reef selected. Thus, mispickel and galena are absent from some, while calcite, very abundant in one or two localities, is very scarce in most of the ore bodies. The occurrence of gypsum (at the Little Wonder) is interesting, as showing comparatively modern metasomasis of one of the gangue minerals—*i.e.*, calcite. Contrary to my expectation, it cannot be definitely affirmed that the order of deposition of the various minerals has been the same for all the reefs, though it does appear to have been the same in adjacent joints—*e.g.*, Chandler's and Little Wonder, and Goody's and Brigham Young. More generally, the arsenopyrite or pyrite has been first precipitated and followed by galena, quartz, blende, and chalcopyrite.

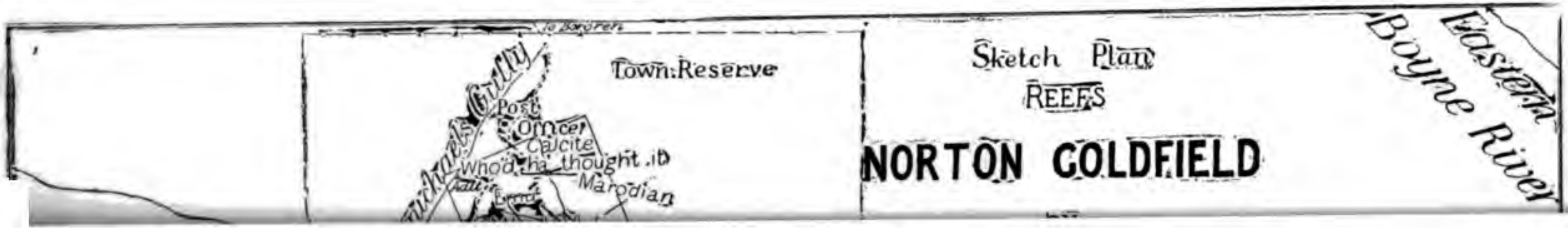
LINES OF REEF.

The reefs are taken in alphabetical order, and described under the older or more common name. Mention of the few claims and leases at work is made in the record of location of and workings on each reef.

Advance (G.M.L. 104).

Location.—The P.C. lies about ¼-mile north-east of the school; the No. 1 South-east is 2 chains distant from the P.C.; the No. 2 South-east is 1½ chains from the No. 1 South-east; and the No. 1 North-west is 1½ chains from the P.C. The workings are on Gold Mining Lease 104.


Sketch Plan
REEFS
NORTON GOLDFIELD
Eastern
Boyne River
Town Reserve
Post
Office
Calcite
Whod ha' thought it
Marodian
Gully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Gully
Post
Office
Calcite
Whod 'ha' thought it
Marodian
Sketch Plan
REEFS
NORTON GOLDFIELD
Eastern
Boyne River

Workings.—The P.C. shaft (poppet-legs), at which steam winding plant was installed in 1888, is 396 ft. deep, the last 76 ft. having been subsidised by the Government. The shaft is now hidden by the ruins of the mullock tip, no work having been done here for the last fifteen years. There are levels 8 ft. to the north-west and south-east at the shaft bottom, and a main drive beneath the No. 1 South workings, at a depth of 270 ft. It is understood that there are stopes for 50 or 60 ft. north-west of the shaft at the different levels, and the Warden, in 1885, reported that a lot of stone was taken from the 320-ft. level.

No. 1 South shaft is about 200 ft. deep. Some stoping was done here between 1881 and 1885.

No. 2 South whim shaft has been officially reported to be 300 ft. deep (water now at 40 ft. from the surface). There are drives extending 100 ft. to the south on the 100 and 200 ft. levels. Some stoping was also done here.

Pot-holes extend from No. 1 North-west for 3 chains up the gully to the Emu reef, and for several chains beyond, but nothing payable was reported.

Reef.—The reef runs N. 38° W. It is vertical to a depth of 200 ft., but underlies 76° to south-west from there to 300 ft. It intersects the Emu line about 10 chains north-west of the Advance P.C.

The ore-body is, as a rule, a wide "formation," 4 to 9 ft. across in the P.C. and 5 ft. in the No. 2 South-east. This consists of altered granite, reticulated and sometimes almost replaced by quartz, the vein being then from 2 to 18 in. in thickness (Rands). The country rock is a jointed granite, which appears to have been highly silicified near the reef.

Parallel reefs occur at ½, 2, and 2½ chains south of the Advance line, but they have not been tested.

Ore.—The quartz carries much mispickel and pyrite and some blende, chalcopyrite, and galena, "with a great deal of calcareous matter, chiefly calcite." "At the bottom of the shaft of the prospector's claim a dark-grey mineral comes in, which consists of antimony sulphide—gold 11 dwt. per ton and silver 2 oz. 15 dwt. per ton, mixed with much earthy matter." The sinking, during 1886, between 320 and 396 ft., was reported to be nearly all mundic.

"The gold runs in shoots, which have a southerly underlie." The contents fell considerably on mundic being struck. In the P.C. the 6-in. reef at the surface carried 15 oz. per ton., and the 2 to 3 ft. reef at the 200-ft. level carried up to 3 oz.; but "at the 130-ft. level the lode is made up of a calcareous rubble containing gold, but not in such qnantity as where the reef is more solid." The gold disappeared at about 300 ft. from the surface, but the 5 ft. of calcareous ore at the shaft bottom contains 8 dwt. per ton. The north-western end of the reef seems to have been poor, the returns even from the No. 1 North-west having been unpayable.

Output—

Claim.	Year.	Material.	Amount.	Total yield.	Yield per ton.	Authority.
			Tons.	Oz. dwt.	Oz. dwt.	
Hickeys ...	1879	...	?	...	15 10	Carmichael
	1880	...	7	44 17 =	6 8½	,,
	,,	...	25	52 6 =	2 2	,,
	,,	Tailings	$0\frac{15}{20}$	4 6 =	5 15	,,
	,,	,,	$0\frac{18}{20}$	0 16 =	0 18	,,
	,,	...	100	257 10 =	2 11½	,,
	,,	...	80	136 10 =	1 14	,,
	,,	...	31	284 0 =	9 3½	,,
	,,	...	3	12 0 =	4 0	,,
	,,	Screenings	14	10 0 =	0 14	,,
	,,	...	4½	56 0 =	12 9	,,
	,,	...	20	143 0 =	7 3	,,
	,,	Casings	17	16 7 =	0 19	,,
	,,	Surface	5	4 13 =	0 18½	,,
	1881	...	52	78 10 =	1 10	,,
	,,	Tailings	22	52 5 =	2 7½	,,
	,,	,,	$4\frac{10}{20}$	3 15 =	0 16½	,,
	1882	,,	3	2 9 =	0 16	,,
	,,	...	88	208 0 =	2 7½	,,
	1884	...	100	186 0 =	1 17	,,
	,,	...	116	202 14 =	1 15	Rands
No. 1 S.E.	1880	Surface	5	12 10 =	2 10	Carmichael
	,,	...	26	122 10 =	4 14	,,
	,,	...	12	36 0 =	3 0	,,
	,,	Tailings	2	0 18 =	0 9	,,
	1881	...	15	23 6 =	1 11	,,
	1882	...	$8\frac{13}{20}$	13 0	1 10	,,
	,,	...	8	16 6	2 1	,,
	1887	...	41	71 15	1 15	,,
No. 2 S.E.	1881	...	30	60 15	2 0½	,,
	1882	...	110	219 0	2 0	,,
	1884	..	$68\frac{10}{20}$	219 5	3 4	,,
	1888	...	8	29 0	3 12½	,,
No. 1 N.W.	1881	...	20	13 4	0 13	,,
No. 2 N.W.	,,	...	9	11 11	1 6	,,
Partial total	...	... ...	1,057	2,604 18 =	2 9½	

ALL NATIONS (M.L. 98).

Location.—Nearly ¾-mile south by east from the school, and 2½ chains south-south-west of the south-western corner of M. L. 79. The workings are in the north-western part of M. L. 98, which was abandoned during 1905, and they lie 5 chains W. 25° S., from the Frampton main shaft.

Workings.—The main workings comprise two 60-ft. shafts, a chain apart, with communication at the deepest point. Osborne's whip, the eastern shaft, was sunk to 30 ft. fifteen years ago. Two chains west of the second shaft there are a few pot-holes in which, however, nothing can be seen of the reef.

Much trouble was experienced with water in sinking here, and it now stands in the shafts at a depth of 25 ft.

Reef.—The reef runs E. 12° S. On its line of continuation a 2-ft. calcite lode, dipping 80° to N. 16° E., has been exposed in the bed of Norton Creek, a few chains above the eastern boundary of M. L. 98.

The reef is only 4 in. wide, but the returns have been good. There is "no mullock between the mundic and the walls" (Rands).

The country rock is a very hard and fine-grained granite.

Ore.—The ore from Osborne's whip is said to have carried much silver and lead. That at the brace of the western shaft consists of sulphides, laminated with and crystallised in calcite, the cleavage faces of which are much curved. These sulphides consist of crystallised pyrite and blende (both in the quartz veins and in bunches of calcite), and a fair amount of galena. "The mundic assayed from 2 to 3 oz. per ton . . . worth only from £2 to £2 10s. per oz." (Rands). In 1880 the Warden reported that the miners were on pay-stone.

The water here was, contrary to the usual experience in this part of the field, quite free from acid, owing to the presence of much calcite in the reef.

Output—

Year.	Amount.	Total Yield.		Yield per ton.	Authority.
	Tons.	Oz. dwt.		Oz. dwt.	
1882	12	15 12	=	1 6	Carmichael
"	5	26 12	=	5 $6\frac{1}{2}$	"
18/4/1905	32	...	=	1 $14\frac{1}{4}$*	Osborne
			=	6 0 †	"
"	12	...	=	1 6 *	"
			=	4 0 †	"
"	$9\frac{18}{20}$	...	=	3 $3\frac{3}{4}$*	"
			=	11 0 †	"
"	$5\frac{10}{20}$	...	=	1 $7\frac{1}{2}$*	"
			=	6 0 †	"
Partial total	76	151 4	=	2 0	

* Gold. † Silver.

BALD HILL (M.L. 111).

Location.—Within ¼-mile east from the school. The lessees (M. L. 111) are exempt for six months, from January, 1906.

Workings.—The Bald Hill shaft lies E. 9° S. from the school, and E. 67° S. from the post office. It is 60 ft. deep, and there is a drive running 65 ft. west. Work ceased here at the beginning of 1905, and water now stands within 40 ft. of the surface.

The new shaft in the gully (lying E. 9° S. of the school, and E. 46° S. of the south-western corner peg of M. L. 104), is 50 ft. deep, but is flooded below 30 ft. It is proposed to continue the sinking to 120 ft., to test the ground with a view to smelting. Alongside this shaft is a cutting 15 ft. deep, 4 ft. wide, and 10 ft. into the hillside.

The old adit is 1 chain east of the new shaft. It runs in about 50 ft. to the south, and a drive then continues east 20 ft. to the air shaft, and for 20 ft. beyond, when it bends to the south-east and continues 20 ft. further. The air shaft was sunk 50 ft. below the level of the adit. From the bottom a drive was opened back 30 ft. to the west to Carmichael's winze, and the ore then stoped up. Carmichael's winze at the end of the adit was 25 ft. deep originally.

Reef.—The Bald Hill shaft (as well as the other) is on a line of altered country ("formation") running E. 8° S., and traceable for miles. In the cutting adjacent to the new gully shaft 4 ft. of this formation has been exposed, but it has not a promising appearance.

Ore.—The ore at the brace of the Bald Hill shaft consists of quartz carrying only mispickel and pyrite, with stains of scorodite (arsenate of iron), and it appears to have occurred as ill-defined leaders in a granite formation, but Captain Osborne tells me that in the face of the drive there is 9 ft. of dense pyrite, carrying—

Copper = 1½ %; and gold = 19 dwt. per ton.

The new shaft in the gully has produced chiefly rotten granite, iron-stained along cracks and joints, but showing also some scorodite. A 2-in. leader of sulphides must have been struck in the shaft. This contains a fair amount of chalcopyrite with mispickel, pyrite, and quartz, but no calcite. In the cutting near the shaft can be seen flat joints dipping 20 degrees to the north, while the master joints run about south.

In the adit drive can be seen gossany decomposed granite, with brown (oxide), and green (sulphate) iron stains. One lenticular patch of poor ore shows up to 7 in. decomposed pyrite and quartz. It is understood that the ore occurs scattered through the 12 ft. rotten formation in masses of a few hundredweights at most. Carmichael's winze was on a richer patch, covering an area of 1 yd. by 3 yds. at the intersection of joints. The body yielded only 25 tons of ore, and then passed into stringers on all sides. A private analysis of Carmichael's ore gave—

Copper = 3%; gold = 1 oz. 4 dwt. per ton; and silver = 7 oz. per ton.

The copper has here been precipitated in bunches by the action of the kaolin of the decomposed granite. At a very slightly lower depth the granite has been found to be simply veined with quartz carrying coppery pyrite.

Output—

Claim.	Year.	Amount.	Treatment.	Product.	Analysis Product.	Authority.
Carmichael's Winze	...	Tons. 25	Smelted	2 tons matte	Per ton. Gold = 3½ oz. Silver = 48 oz. Copper = 9 %	Carmichael
Osborne's ...	...	30	...	...	...	,,
		30	...	...	...	,,
		30	...	...	..	,,

BRIGHAM YOUNG (TADMAN'S TAPAUTOHAUNGA).

Location.—A little over ½-mile south-south-west of the school, and 3 chains N. 35° W. of Goody's main shaft.

Workings.—An old underlie, originally 35 ft. deep, has been continued into the new workings.

Tadman's new vertical shaft is 30 ft. south-west of the underlie, and is 44 ft. deep. At the bottom is a crosscut northwards to the reef, along which a drive has been carried eastwards to the underlie (at 15 ft.), and 20 ft. beyond.

Adjacent to these workings opencuts have been opened on parallel leaders at opposite ends and sides of the main reef.

Reef.—Runs E. 7° S. (dipping 1 in 6 southwards) for a chain, and breaks over to the south at the eastern end, and to the north at the western.

The reef in the 44 ft. level gradually increases from 6 in. at the underlie shaft to 18 in. (solid sulphide) in the eastern face, where it is bending round still more nearly eastwards. The reef was probably small near the surface where richest.

The country rock is granite, jointed parallel to the reef, with ¼-inch leaders on the joints. The walls, though well defined, are not slickensided, and the ore is "frozen" to the hanging-wall. A diorite dyke 8 ft. to the south of the reef on the crosscut strikes west 10 degrees south.

Ore.—The ore in the face on the 44-ft. level is dense pyrite, with bands of other sulphides (25 per cent. galena in one place). A specimen is said to have assayed—

Gold = 4 oz. 8 dwt.; and silver = 8 oz. 17 dwt. per ton.

There were 8 or 9 oz. yields on top.

In my sample (93), from the 3 tons at grass, as well as from the face, the ore is laminated to some extent, and consists of:—

(1) Quartz and pyrophyllite (5 per cent.)—silica (besides the original) crystalline in vugs, in dogtooth form in veinlets, and as crystals on the pyrite, in which is also some secondary silica. Quartz can also be seen to have replaced country rock.

(2) Blende (20 per cent.)—chiefly in the interspaces between the pyrite crystals, but also along fissure zones, and occasionally as crystals in the dogtooth quartz. Seldom on the same side of veinlets as the galena.

(3) Pyrite (50 per cent.) straited cubes.

(4) Galena (25 per cent.)—on irregular lines in crystal form among and around which pyrite has been deposited, bu never blende; cleavage faces sometimes curved; seldo massive.

(5) Malachite (traces).—Stains in a leached vug in ore specimen

The order of deposition of the minerals has thus been—(i.) pyrite (ii.) galena, (iii.) blende, (iv.) quartz, (v.) malachite.

Assay (Government Analyst)—

Gold = 1 oz. 0 dwt. 9 gr. per ton
Silver = 12 oz. 11 dwt. per ton.

Analysis (Government Analyst) not expected to be available fo some months.

The above approximate estimation would indicate the presence of—

Zinc = 13 %
Lead = 21½%

Output—

Claim.	Year.	Amount.	Total yield.	Yield per ton.	Authority.
		Tons.	Oz. dwt.	Oz. dwt.	
Present face 44 ft. level	1881	9	23 5	2 11¾	Carmichael
	1895	1$\frac{6}{10}$	...	1 13 *	Tadman
		...	...	11 0 †	
Partial total	...	10½	25½ 0	2 8½	

* Gold. † Silver.

CALCITE.

Location.—2 chains south of the post office.

Workings.—The shafts have long been abandoned.

Reef.—Strikes W. 40° N.

Calcite blocks on the surface prove that the lode is at least 9 in. wide.

Remarks.—A 3-in. or 4-in. leader parallel to and 1 chain north-east of the above has been sunk on to a depth of 200 ft.

CARMICHAEL'S GULLY (G.M.L. 104).

Location.—The mouth of the adit is 2 chains E. 5° S. from the north-western corner of M.L. 104.

This adit has hitherto been considered to be on the Advance line.

Workings.—For 30 ft. (including 15 ft. cutting) the adit runs E. 27° S., and then about 105 ft. E. 10° S. The reef is, therefore, not the Advance.

Reef.—The strike is easterly and westerly, and the dip is 1 in 6 to the north.

The leader is 2 to 4 in. wide, well defined. An 8-in. reef is reported in the well just outside the adit.

Ore.—It consists mostly of calcite, with black laminations parallel to the walls; very little sulphide. The calcite is sometimes rose-coloured, and its cleavages surfaces are generally curved.

CHANDLER'S (M.L. 79).

Location.—The main adit is situated in M. L. 79, about 5 chains south of the northern corner.

Workings.—The workings on Chandler's reef extend right across M. L. 79, and beyond it to Norton Creek, where an adit was begun but was abandoned because of the smallness of the lode. The reef has been opencut to a depth of 20 ft. from the eastern boundary of the lease for 1½ chains towards the west. A shaft was sunk in it for mundic ore, but now contains water to within 10 ft. of the surface.

The reef has been guttered at intervals above and to the west of Chandler's adit, which is in about the centre of the lease (4 chains from the eastern line).

The main adit crosses the Little Wonder reef at 20 ft. from the mouth, and a short distance north-west of the intersection of that reef with Chandler's. At 30 ft. from the mouth, Chandler's reef was cut, and it has been followed for 150 ft. to the west.

Further, a shaft, known as the Frampton North or Osborne's No. 1, has been sunk 25 ft. on a rich patch at the junction of this reef with the Frampton. This shaft has, during the past two years, been continued by Captain Osborne an additional 75 ft., but the timbers having been drawn it is now inaccessible. From Captain Osborne I understand that drives have been opened 65 ft. east and 32 ft. west, proving an average width of 18 in. of pyritic material worth 11 dwt. per ton.

The only work now going on along the line is in Chandler's adit, where one man is "mullocking down" from the old surface workings. The method of breaking down has hitherto been by overhand stoping, but it is proposed to connect with the old workings 30 ft. above the adit, and then sink a new shaft.

Reef.—The general strike is east and west, though at the eastern end it is east-south-east. The dip is northwards 1 in 10 vertical in the main adit, but at the eastern end it is vertical. It intersects both the Little Wonder and Frampton's reef.

In the old surface workings west of the adit the reef "varied in thickness from 1 to 3 ft." At the adit it is 6 in. thick, and that may be taken as a general average—between 3 in. and 12 in.; but the footwall granite is in places also veined and patched for 12 in. from the centre of the reef. The walls are good, there being generally 2 i decomposed granite on the hanging (northern) wall, but there is al a central fissure, which increases the probability of permanence.

The auriferous shoots on this line generally pitch westwards, b except at the Frampton North no gold has been found west M. L. 79.

Ore.—Marcasite (?) from the reef has been assayed for 1 oz. a 1½ oz. per ton, and the ore from the adit, when hand-picked, l yielded 3 oz. 6 dwt. on crushing, while the "seconds" concentra gave 4 oz. 5 dwt. per ton. "The gold . . . is worth only fr £2 to £2 10s. per oz."

In my sample (96) from the whole surface of the 25 tons grass the ore is evidently replaced shattered granite. It consists o

(1) Quartz and pyrophyllite (60 per cent.)—quartz, b original and in glassy dogtooth form, almost free fr pyrite.

(2) Pyrite (20 per cent.)—modified cubes disseminated throu quartz.

(3) Mispickel (5 per cent.)—small blady crystals dissemina through quartz.

(4) Chalcopyrite (5 per cent.)—irregular branching forms quartz, probably infilling spaces in same, associated w massive mispickel; also as bunches in the blende.

(5) Blende (10 per cent.)—almost massive, interbanded w pyrite, and also crystallised in quartz (?).

(6) Grey ore (traces)—in white quartz.

(7) Scorodite (traces)—encrusting cavities.

(8) Azurite (traces)—stains in cavities.

(9) Malachite (traces)—stains in cavities.

Order of deposition: (i.) Mispickel, (ii.) pyrite, (iii.) quartz, (i blende, (v.) chalcopyrite, (vi.) grey ore, (vii.) scorodite, (viii.) azuri (ix.) malachite.

Assay (Government Analyst):—

Gold = 3 oz. 3 dwt. 4 gr. per ton
Silver = 4 oz. 17 dwt. per ton.

Analysis (Government Analyst) not expected to be available f some months.

The above approximate estimation would indicate the presence of—

Zinc = 6½ %
Copper = 1½ %

Output—

Year.	Amount.	Material.	Treatment.	Yield.	Yield per ton.	Authority.
	Tons.			Oz. dwt.	Oz. dwt.	
1879	4 17/20	...	...	3 7	0 13¾	Carmichael
,,	45 10/20	...	...	98 0	2 3	,,
,,	35	...	...	60 3	1 14¼	,,
1880	14 10/20	...	...	22 13	1 11¼	,,
	15	...	...	13 16	0 18½	,,
	14	...	...	22 10	1 12	,,
1882	10	Surface	.	10 9	1 1	,,
	30	...	Chlorinated*	=	2 0	,,
	200	...	,,	...	...	,,
	1 3/20 §	...	...	...	1 15†	,,
	.	...	...	...	10 0‡	,,
	25	...	At grass	...	...	,,
Partial total	170			293 1=	1 14½	

* The second attempt to chlorinate was reported to be a failure because of the presence of zinc

† Gold.

‡ Silver.

§ From the adit—treated in England. Contained zinc = 22°/₀.

DENT'S.

Location.—Half-mile south-west of Brigham Young.

Output.—Five tons crushed are reported to have yielded—

Gold = 1 oz ; silver = 32 oz. per ton.

DYKE.

Location.—On Norton Creek, about 10 chains above M. L. 98.

Workings.—None.

Reef.—There is here a 6-ft. dyke striking W. 10° N. parallel to the jointing of the granite. On the northern side is 4 to 6 in., and on the southern side 2 to 4 in. calcite, containing a little mineral—*i.e.*, sulphide.

EMU (G.M.L. 104).

Location.—Lies 5 chains S. 44° W. from Marodian shaft, and 3 chains N. 10° W. from the P.C. Advance. The workings are near the centre of G.M.L. 104.

Workings.—The main whip shaft is 160 ft. deep, and the eastern whip shaft, which has been filled in, 200 ft.(?) deep. The workings extend for 3 chains west of the intersection with the Advance line of reef, which is about 10 chains north-west of the Advance P.C.

Work ceased here four years ago, and consequently the shafts cannot be examined.

Reef.—The strike is W. 4° S. and the dip about 1 in 10 or steeper northwards.

The reef's thickness, varying between 1 and 6 in., averages 4 in.

Several outcrops (of ochreous and honeycombed quartz) with a east and west course have been tried on the western side of the ridg on which are situated the Emu and Advance workings.

Ore.—The ore is a "quartz and calcite gangue containing th mundic," and "went from 1 to 6 oz. per ton, being richer when smaller.

A very rich shoot of gold lay east of the whip shaft, from whic yields of 10 oz. (plus 2 oz. in tailings) per ton were obtained. West o the whip shaft was a blank to the creek, 2½ chains distant. At tha point is the intersection with the Advance line, beyond which ther were yields of 3 oz. per ton—presumably on No. 4 W., where payston was reported in 1880.

Output—

Claim.	Year.	Crushing.	Yield per ton.	Authority.
			Oz. dwt.	
P.C. ...	1880	26 tons for 40 oz.	1 11	Carmichael
	1882	9 tons for 42 oz. 9 dwt.	4 14	,,
		32 tons for 36 oz. 15 dwt.	1 3	,,
1 W. Emu ..	1880	8½ tons for 17 oz. 10 dwt.	2 1	,,
		14 tons for 42 oz. 14 dwt.	3 1	,,

Partial total, 89½ tons for 179 oz. 8 dwt. = 2 oz. per ton.

FRAMPTON (MARTIN'S OR CONRAN'S, M.L. 79).

Location.—Nearly ¾ mile south-south-east from the school. Th workings are now included within Carmichael's M.L. 79, of 10 acres.

Workings.—Most of the preliminary work was done by th Frampton United Company, who took up the ground in 1884. B 1886 they had prospected the whole length of Martin's reef, in place for 150 ft. from the surface. The claim, still known as Frampton' United, was worked from 1888 till 1891, by Conran's G.M. Co Everything appears to have been going smoothly in 1889, but in 189 it was proposed to cease work. Exemption was secured for six month in the following year, and subsequently tributes were let. The com-pany seems to have passed out of existence in 1892, and since then th ground has been in Mr. Carmichael's hands.

The main shaft, at which there is a head frame, is 320 feet deep but it is now falling in. There are understood to be levels at 40 ft. 90 ft., 180 ft., etc.

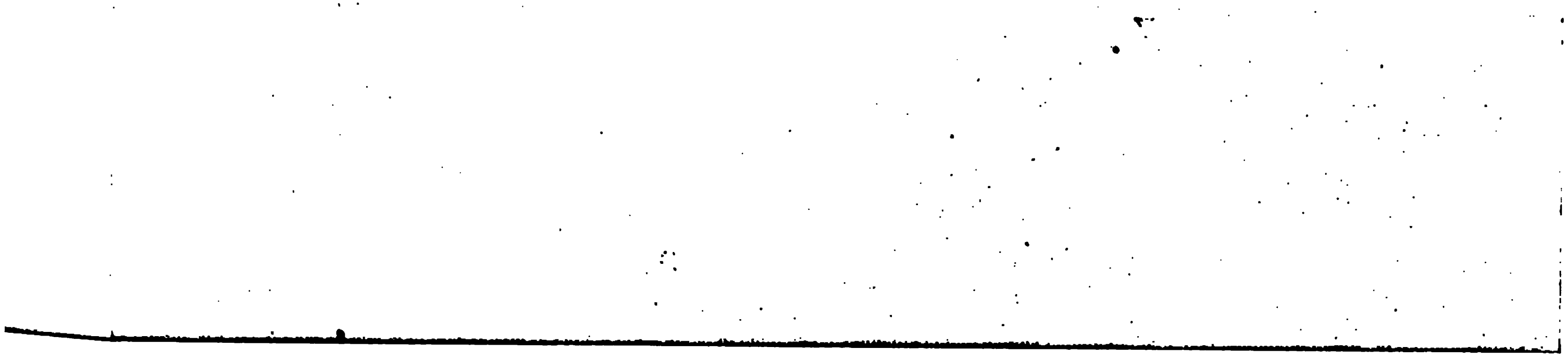
The south-eastern shaft is ½ chain to the south-east of the main shaft.

Frampton's first shaft is 2 chains to the north-west—and wa originally 60 ft. deep.

Another shaft, 4 chains to the north-west (within ½ chain of the boundary of the lease), is 60 ft. deep.

There are open cuts between Frampton's first and the south-eastern shafts, and on the leader for 1 chain from the main reef, beyond which only a mass of leaders could be found.

Plate II.



Some 5 or 6 chains from the Frampton workings is the Frampton North shaft (Osborne's), originally 25 ft. deep, but lately continued 60 ft. by Captain Osborne.

Reef.—The strike is E. 38° S. from the north-western boundary of the lease, and the dip is 1 in 12 to the south-west. This reef intersects Chandler's.

"Martin's reef can be traced for a quarter of a mile along the summit of the ridge." There were good walls in the main workings, but the reef splits up into numerous leaders (carrying gold when honeycombed), within a chain of the main shaft on the south-east and in G.M.L. 130 on the north-west. "On Martin's claim, towards the west, it is as much as 8 ft. thick, and the mundic is 3 ft. thick at the bottom of Mr. Frampton's shaft, about 40 ft. deep." In the north-western shaft an 8-ft. formation, pitching southwards, was found to a depth of 60 ft. Below it the mundic ore carried only 6 dwt. per ton. About ½ chain south-east of this shaft can be seen 3 ft. of poor ore (quartz and calcite) with beautifully slickensided western wall but indistinct eastern wall. The ore here is reported to be rich wherever honeycombed. Beyond this again 2 ft. of surface was proved to carry 8 or 9 dwt. About ½ chain south-east of Frampton's first shaft a branch leaves the main reef for 2 chains, and the whole of the country between the two reefs (up to ½ chain across and 6 ft. deep) has been crushed. Below that "mineral" was found.

On the 90-ft. level the arched stringer is said to be 9 in. thick, and to carry 7 oz. per ton, but near the surface it increased to 2 ft. and yielded 14 dwt. per ton. There is "no mullock between the mundic and the walls" (Rands).

The Frampton North shaft, as first sunk, was on a rich patch, but the continuation is believed to have been poor, the gold being in the sulphides.

Ore.—Near the surface the stone assayed 2 to 4 oz. per ton, and the lower levels were reported to be richer than the upper in 1888, but the gold is said to have been lost at 200 ft. Mr. Carmichael believes that the shoot pitches southwards, and was sunk through.

In 1890, Mr. Rands* inspected the 180-ft. level, and found 8 to 16 in. mundic (iron and arsenical pyrite, blende and galena), occurring in shoots in greyish mullock, between hard granite walls.

The ore is evidently from a "formation"—quartz stringers and replacements, with lines of blende and bunches of pyrite and galena and patches of calcite. A few tons were handpicked and sent away by Captain Osborne.

The water in this mine carries much acid.

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* G. S. Q. Publication No. 58. Annual Progress Report of William H. Rands, Assistant Government Geologist, for 1890.

Ore.—The sinking in Carmichael's shaft was cellular quartz veined, altered kaolinised granite. The stone here is understood to be practically free from blende, and it is therefore proposed to smelt it. Mixed sulphides occur, however, 30 ft. to the west and 2 chains to the east.

At Goody's the country rock of the ore formation was removed in the mine, and the blende was picked out on the surface. In my sample (95), from the ton at grass, the ore, showing no banding but fairly plentiful leached cavities, consists of:—

1. Pyrite (50 per cent.)—massive and crystallised. Sheets of pyrite cross cavities and connect with crystals.
2. Blende (20 per cent.)—crystallised in quartz and filling interspaces between pyrite and quartz crystals; also drusy on quartz crystals in cavities and often on opposite sides of veinlets.
3. Galena (10 per cent.)—crystals surrounded by pyrite.
4. Mispickel (10 per cent.)—very fine grained crystalline or massive in siliceous country.
5. Quartz (10 per cent.)—filling interspaces between pyrite crystals and also crystalline in the same spaces; perfect crystals in galena. One vein of dogtooth structure was deposited on pyrite, after which galena filled in the interspaces in the quartz.
6. Grey ore (trace)—crystals in quartz veinlets, especially where there is a coating of blende.

Order of deposition: (i.) Mispickel, (ii.) galena, (iii.) pyrite, (iv.) blende, (v.) grey ore, (vi.) quartz.

Assay (Government Analyst):—

Gold = 19 dwt. per ton.
Silver = 16 oz. 8 dwt. per ton.

Analysis (Government Analyst)—not expected to be available for some months. The above rough estimation indicates the presence of: Zinc = 13 per cent., lead = 8½ per cent.

At about ½ chain south-east of the main shaft is a 12 ft. dyke dipping south-east, beyond which, instead of a single reef, there are two about 25 ft. apart at the dyke, and coming together within 2 chains from it. On the surface the north-eastern "formation" is 18 in., and the south-western formation 2 ft. 6 in. wide. They were both rich, and have been open cut to their junction, but on the 90-ft. level only the southern reef has been cut, and, though very small, it

Reef.—The Galena reef at the Silver Mine strikes W. 4° S., any variation from the vertical being northwards. At Morrison's it runs east and west, underlying 1 in 10 v. southwards; and at Booth's it runs E. 3° N., and dips 1 in 20 southwards.

It is 10 in. to a foot in width at the Silver Mine, and "is separated from the granite walls by a casing of mullock consisting of broken granite, the distance between the walls being three to four feet." On Morrison's bottom level the ore body consists of 2 ft. 6 in. granite, with 3 in. pyrite on the footwall, 1 in. pyrite on the hanging-wall, and leaders throughout. On the 40-ft. level the walls, 2 ft. 6 in. apart, are slickensided. Above this level the reef is on the footwall, but below it is on the hanging-wall. The drive at the 70-ft. level shows 12 in. of fissured granite, with lines and bunches of sulphides.

The walls of Booth's formation are 3 ft. 9 in. apart near the surface.

Ore.—The ore raised from the old Silver Mine contained a good deal of galena, and owing to the high proportion of silver the bullion was worth only £1 10s. per oz.

That from Morrison's shaft consists of—quartz and pyrophyllite, 50 per cent.; pyrite, 40 per cent.; galena, 5 per cent.; and blende 5 per cent. (in bunches). It is said that the surface stone yielded 3 oz. per ton, and that as soon as the blende came in the gold fell to 1 oz. per ton. My sample (99) of the 3½ tons concentrates (from 7 tons "seconds") at the battery consists of a very fine mixture of pyrite and galena.

Assay (Government Analyst):—

Gold = 2 oz. 8 dwt. 9 gr. per ton.
Silver = 5 oz. 3 dwt. 13 gr. per ton.

Analysis (Government Analyst) not expected to be available for some months.

The ore from Booth's shaft is a decomposed granite veined with quartz carrying sulphides, in which it is rather richer than that from Morrison's shaft. In my sample (94), from the ½ ton of "firsts" still at the shaft, the ore consists of:—

(1) pyrite (50 per cent.)—irregularly in galena.

(2) galena (25 per cent.)—massive, filling cracks in the original quartz-pyrophyllite rock, also blady forms in pyrite and as bands.

(3) blende (10 per cent.)—this small quantity occurs with the quartz in pyrite.

(4) quartz (10 per cent.)—filling interspaces in pyrite, and including pyrite crystals and occasional veins.

(5) chalcopyrite (5 per cent.)—irregular forms filling interspaces in the galena.

Order of deposition: (i.) Galena, (ii.) pyrite, (iii.) chalcopyrite, (iv.) quartz, (v.) blende.

LITTLE WONDER (G.M.L. 130).

Location.—Slightly over ½ mile south by east from the scho The workings are included in G.M. Lease No. 130, of 20 acres, whi adjoins M.L. 79 on the west.

Workings.—The reef has been open cut for a distance of 5 chai beginning at a chain from the north-western boundary of M.L. 79, a it has been pot-holed for a further distance of 5 chains to the nort west.

Conran's shaft, 1 chain from the south-eastern end of the cut, 50 ft. deep.

The Little Wonder shaft, a chain to the north-west, was origina 30 ft. deep, but Captain Osborne has sunk it to 65 ft., opening driv for 76 ft. to the east and 60 ft. to the north. It is now half full water.

The ladder-way, or western shaft, 120 ft. deep, a chain to t north-west, could not be inspected because of foul air. Capta Osborne reports having at the 60-ft. level driven east 45 ft. and we 65 ft.

A line of reef has been exposed on M.L. 98, on the bluff abo Norton Creek, east of M.L. 79. This is believed to be the continuati of the Little Wonder, the same line having been open cut to 20 depth about 2 chains south-east of Chandler's adit.

Reef.—The reef on G.M.L. 130 strikes N. 58° W., dipping steep north-east at the Little Wonder and south-west at the ladder-way shaf On M.L. 98 the strike is N. 65° W.; and the dip is 85° to the nort east. The reef was traced along the surface for over 300 yards b Mr. Rands.

The reef was 18 in. wide at the south-eastern end of the mai workings (Rands). Captain Osborne reports the average width of th lode in the Little Wonder shaft to have been 14 in. (pyritous ston averaging 3½ oz. per ton). In the eastern drive here the average widt of the lode was 9 in., and the western 4 in. (2½ oz. per ton). Th average width of the lode in the ladder-way shaft eastern workings wa 6 in., and in the western workings 8 in.

At the north-western end are no defined walls, there being a big "formation" of leaders, "frozen" to the decomposed granite. Generally, however, there is no mullock between the mundic and the walls.

The best shoot of gold is understood to be just to the south-east of the Little Wonder shaft.

The country rock is a very hard granite, and on M.L. 98 it can be seen to be considerably jointed, the master joints running parallel to the reef, while there are also horizontal joints and two sets of subsidiary joints making an angle of 45° with the reefs.

At the eastern end of the main workings on M.L. 130 there are two reefs lying parallel to the Little Wonder, one 20 ft. to the south-west and a second 1½ chain beyond. The first has been trenched for about a chain from M.L. 79.

Ore.—The ore consists, on M.L. 98, of 6 in. of promising gossan on the surface; sulphides, carrying 13 dwt. gold, are reported to occur a few feet below; while 2½-oz. stone was raised from the trench 2 chains south-east of the adit. At the main workings the quartz carries much pyrite and a little chalcopyrite, while in one place crystals of gypsum were found between the quartz and pyrite. The gypsum is evidently a secondary product formed by the action of sulphuric acid (set free by the decomposition of pyrite) on the calcite. The coarser pyrite has generally been found here to be poorer than the finer, which has assayed "a little over 1 oz. of gold and 4 oz. 17 dwt. of silver per ton." "The gold is worth only from £2 to £2 10s. per oz" (Rands).

In my sample (97), from the 20 tons "seconds" at the Little Wonder shaft, the ore (granite "formation") consists of:—

1. Quartz and pyrophyllite (70 per cent.)—quartz crystallised in cavities, and crystalline in pyrite interspaces. Some cellular.
2. Mispickel (15 per cent.)—disseminated through the pyrophyllite-quartz rock between the two minerals; also banded with pyrite.
3. Pyrite (15 per cent.)—crystallised on pyrophyllite, on dog-tooth quartz in mispickel, and also in sheet form.
4. Blende (traces)—occasional fillings in quartz veinlets and pyrite.
5. Chalcopyrite (traces)—irregularly in quartz and filling cavities in pyrite.

Order of deposition: (i.) Mispickel, (ii.) pyrite, (iii.) quartz, (iv.) blende, (v.) chalcopyrite.

Assay (Government Analyst):—

Gold = 1 oz. 9 dwt. 19 gr. per ton.
Silver = 3 oz. 16 dwt. 9 gr. per ton.

Analysis (Government Analyst)—not expected to be available for some months. Only traces of zinc, lead, and copper are to be hoped for.

***Output*—**

Claim.	Year.	Crushing.	Yield per ton.			Authority.
			Oz.	dwt	gr.	
Osborne's Frampton	1880	4 tons for 5 oz. 14 dwt.	1	8½	0	Carmichael
		20 tons for 21 oz. 4 dwt.	1	1¼	0	,,
North End	1879	22 tons for 28 oz. 15 dwt.	1	6	0	,,
		15 tons for 27 oz. 18 dwt.	1	17	0	,,
		38 tons for 60 oz. 0 dwt.	1	11½	0	,,
		21 tons for 25 oz. 0 dwt.	1	3¾	0	,,
		27 tons for 40 oz. 5 dwt.	1	9¾	0	,,
	1881	22 tons for 17 oz. 0 dwt.	0	15½	0	,,
	1882	9½ tons for 29 oz. 10 dwt.	3	2	0	,,
Osborne Shoot No. 1 W.	1879	3$\frac{7}{20}$ tons for 9 oz. 1 dwt.	2	14	0	,,
		8 tons for 8 oz. 0 dwt. mundic	1	0	0	,,
		4½ tons for 4 oz. 10 dwt. (7 oz. stone)	1	0	0	,,
Little Wonder Shaft	1903	9 tons 2 cwt. treated for gold	1	10	17	Osborne
		silver	4	19	0	,,
	26/5/03	6 tons 12½ cwt. treated for gold	1	13	7	,,
		silver	Nil			,,
	4/8/03	5 tons 11 dwt. treated for gold	1	8	19	,,
		silver	3	11	14	,,
	25/7/04	15 tons 3 cwt. treated for gold	2	19	14	,,
		silver	7	3	14	,,
Eastern drive, Little Wonder Shaft	19/2/03	2 tons 10 cwt. for gold	3	18½	0	,,
		silver	8	18	0	,,
	19/2/03	2 tons 5 cwt. for gold	3	18	0	,,
		silver	6	10	0	,,
	4/8/03	8 tons 8 cwt. for gold	3	8	0	,,
		silver	7	3	0	,,
	4/8/03	8 tons 1 cwt. for gold	3	12	0	,,
		silver	8	13	0	,,
Ladder-way Shaft	25/4/04	10 tons 15 cwt. for gold	6	18	9	,,
		silver	8	4	0	,,
	25/7/04	2 tons 18 cwt. for gold	2	10	0	,,
		silver	4	7	14	,,
Eastern drive, Ladder-way Shaft	25/7/04	13 tons 15 cwt. for gold	3	0	0	,,
		silver	11	0	0	,,
Western drive, Ladder Shaft	26/5/03	5 tons 1 cwt. for gold	2	0	0	,,
		silver	4	17½	0	,,
	25/7/04	17 tons 4½ cwt. for gold	2	1[illegible]	0	,,
		silver	9	12	0	,,

Partial total, 303 tons for 653 oz. = 2 oz. 3 dwt. per ton.

MAHOGANY (G.M.L. 104).

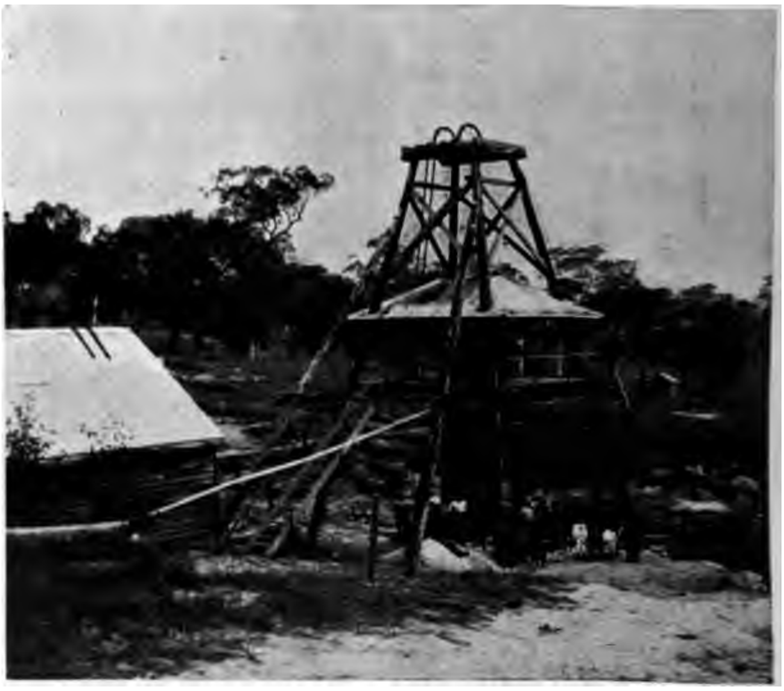
Location.—The shaft is on M.L. 104, 4 chains S. 4° E. from the Marodian main shaft.

Workings.—These—a shaft, a trench ½ chain to the south-east, and a hole 1 chain to the north-west have all fallen in. In addition to them there is an adit (in the bank of the creek at the north-western end), where some gold shed from the reef was obtained.

Reef.—The line of strike is N. 52° W.

Though 4 ft. of mundic was reported at 40 ft. depth, only fragments of "formation" (granite, with bunches of calcite and impregnations of pyrite) can be seen at the brace. Further, the yield given below is said to have been really from a small leader running with the sulphides.

Plate III.



MARODIAN MINE, NORTON GOLDFIELD. [*Tadman, photo.*

Output—

Crushing.	Yield per ton.	Authority.
15 tons sulphides gave 10 oz. ... ... The gold was worth £3 10s. per oz.	13¼ dwt.	Carmichael

MARODIAN (G.M.L. 104).

Location.—⅜ mile north-east from the school-house.

The lease (M.L. 104, of 40 acres) was taken up in 1903, but work ceased towards the end of 1904, after £2,800 had been expended in crosscutting, driving, and in machinery, etc.

It was under exemption during the whole of 1905.

Workings.—The Marodian shaft (originally the Who'd-ha'-Thought-It) is said to be 320 ft. deep, and has been cleaned out and re-timbered to 200 ft. from the surface. During 1904 the following work was done. Levels were opened at depths of 120 and 200 ft. At the former depth a crosscut was carried 50 ft. to the south, and drives were opened at 15 ft. from the shaft for 65 ft. east and 100 ft. west. At the latter level crosscuts were carried 15 ft. to the south where a drive was opened 45 ft. east, and 10 ft. north where a drive was opened 96 ft. west. No work has been done since July, 1905, and water is now at 40 ft. below the surface.

The Marodian reef and the diorite dyke have been trenched for about 2 chains east of the main shaft.

Reef.—The strike is east and west, the underlie 10° north. The reef meets the Who'd-ha-Thought-It a few feet west of the main shaft, and at somewhere about 200 ft. in the shaft.

The "formation" (granite with quartz) is said to be 3 to 4 ft. wide on the 120-ft. level, "and of this 1 ft. could be considered crushing material, but at the surface and at the 300-ft. level there was only 9 in. to 1 ft." (manager). The reef runs along, and is "frozen" to, a diorite dyke in the lower levels, and was lost in diorite (faulted ?) in the old western workings.

Ore.—In the western shaft at the 150-ft. level, and in the main shaft at the 200-ft. level, the reef, the gangue of which was chiefly calcite, gave very fair prospects when first cut, "but below the reef decreased in contents to a few pennyweights of gold per ton." (Rands).

Gold has not been found in the reef beyond 2 chains east of the main shaft, and when Mr. Rands inspected the mine no payable gold was found between the 290-ft. and 320-ft. levels, where the Who'd-ha'-Thought-It leader is present.

The gangue is chiefly calcite and the gold occurs in the sulphid
In my sample (100), from the 15 tons at grass from the 200-ft. lev
the ore, of which the sulphides show some banding, consists of :—

1. Pyrophyllite (30 per cent.)—of the original country.
2. Quartz (30 per cent.)—dogtooth layers on the country roc
3. Calcite (30 per cent.)—filling interspaces in the dogto quartz.
4. Pyrite (5 per cent.)—coating the country rock under quartz and also crystallised in the quartz pyrophyll country.
5. Blende (5 per cent.)—crystals in the dogtooth quartz.

Order of deposition: (i.) Pyrite, (ii.) blende, (iii.) quartz, (iv.) calcit

Assay (Government Analyst):—

Gold = 1 oz. 6 dwt. 4 gr. per ton.
Silver = 1 oz. 8 dwt. 19 gr. per ton.

Analysis (Government Analyst)—not expected to be available some months. From the above rough estimation only 3 per cent. z is anticipated.

Output—

Crushing.	Yield per ton.	Authority
50 tons from the lower levels returned 150 oz.	Oz. 3	Carmichael
15 tons run of mine at grass.		
10 tons "seconds" at grass.		
The "firsts" from this lot yielded		"

NEVER NEVER (G.M.L. 117).

Location.—On G.M.L. 117, nearly ½ mile south-south-east fr the school-house. The workings are on a gentle rise overlooki Norton Creek.

Workings.—There are two shafts 2 chains apart, both of whi are inaccessible. The western or whip shaft was sunk by the Mund Company about 18 years ago to a depth of 90 ft. It was cleaned o last year and continued 4 ft. by Captain Osborne, but it is now flood to within 30 ft. of the surface. The eastern shaft is 20 ft. deep. A opencut 12 ft. deep extends for a chain west of the whip shaft.

Reef.—The reef strikes east and west, dipping steeply (80°) t the north (at the surface), but to the south below.

It varies between 4 or 5 in. and 18 in. in thickness, and at th eastern end there is a 2-ft. formation, but " there is no mullock betwee the mundic and the walls" (Rands).

Ore.—The reef consists of white quartz, carrying, it is said, 50 per cent. sulphides, including copper (1 per cent.), silver and lead, but samples of the ore cannot now be obtained. "The mundic is a coarse iron and arsenical pyrites" (Rands).

The free gold occurred in a shoot not extending beyond the limits of the whip shaft, though mundic was found in the stone in the ends. The ore from the opencut is reported to have carried only ½ oz. gold, while the 2-ft. formation in the eastern shaft yielded 7 dwt. per ton. Nevertheless, it is thought that the ore, after rough handpicking and concentration, might be worth shipping, though "the gold is worth only £2 to £2 10s. per oz." (Rands).

Output—

Claim.	Year.	Crushing.	Yield per ton.	Authority.
			Oz. dwt.	
P.C. ...	1879	14 tons yielded 32 oz. 6 dwt.	2 6	Carmichael
		(mundic) 3 tons yielded 2 oz. 19 dwt.	0 19½	,,
No. 2 W. ...	1879	11 tons yielded 9 oz. 8 dwt.	0 17	,,
		8 tons yielded 5 oz. 3 dwt.	0 12¾	,,

Partial total, 36 tons for 49 oz. 16 dwt. = 1 oz. 8 dwt. per ton.

NEW CONSTITUTION (OSBORNE'S G.M.L. 103).

Location.—A mile south of the school-house.

A small company was formed in 1904, and erected a crushing plant, with Wilfley table, but soon got into financial difficulties, and abandoned the lease in 1905. The workings are now included in Osborne's G.M.L. 103.

Workings.—The shafts, now inaccessible, were sunk two years ago. The western shaft, 60 ft. deep, is filled with water to within 10 ft. of the surface. At the bottom is a 20-ft. crosscut to the south, with drives both ways on the reef, and above them there are stopes. A cut, 5 chains east of this shaft and 1 chain north of the eastern shaft, is probably on this reef.

The southern shaft, which is 45 ft. (?) deep, is within 20 ft. of the western.

The eastern shaft, which is due south of the school and S. 43° W. from the Frampton, is about 5 chains from the western shaft. Alongside it is an opencut extending 1½ chains westwards, and there are trenches and holes for 2 chains eastwards and beyond.

Reef.—The main reef runs E. 16° S. at the western shaft. Its thickness here is 3 ft. 6 in. The distance between the walls of the southern reef, which is parallel to the main reef and distant 20 ft., is said to be 2 ft. The eastern shaft appears to be on a third reef running W. 5° N. to a point 2 chains south of the western shaft. From the granite on the tip, it is presumed that the reef is small.

Ore.—The ore in the main western shaft was solid mundic, whic however, carried payable gold only in the shaft. The ore of tl southern reef consists of quartz with 10 per cent. mispickel and 10 p cent. crystallised pyrite.

Output—

Claim.	Crushing.	Yield per ton.	Authority.
		Oz. dwt.	
Western shaft	30 tons "firsts" crushed for	1 9	Carmichael
	60 tons		
Southern shaft ...	30 tons crushed for	0 15	,,

Partial total, 60 tons for 66 oz. = 1 oz. 2 dwt. per ton.

OLD.

Location.—½ mile west of the Sulphide, due south of the P.(and ¼ mile E. 16° S. of the Welcome.

Workings.—Old trenches, 20 feet deep.

Reef.—The strike is W. 25° N. and the dip vertical to the north There is 2 ft. altered granite formation with scorodite stains.

PADDOCK (SMART'S, OSBORNE'S).

Location.—Lies E. 14° S. from the Post Office, and 1¾ miles ea from the school-house.

The present work was begun by Smart, but the ground is no held as a claim (Osborne and Charley), which is exempt and deserted.

Workings.—The shaft is understood to be 32 ft. deep, but the is a stage at 15 ft., below which no inspection could be made. Besid this, numbers of pot-holes have been sunk, probably on lenticul patches of ore in joints. Operations were begun in the vicinity pr vious to 1885, but carting was then too expensive for work to b remunerative.

Reef.—The visible lode material in the shaft seems to run sout eastwards, dipping 85° to the north-east. About a foot is ironstained but only 4 in. can be taken as ore, and even this is reported to hav pinched in the drive below.

The country rock is granite, with flat joints dipping north westwards.

Ore.—The brown stone (granite with quartz veins and iro oxides) is reported to carry 4 to 6 oz. per ton. Quartz, with pyrite mispickel, and blende, has been raised from the lower portion of the shaft. The "seconds" on the surface consist of altered granite veined with quartz carrying pyrite and mispickel, but very little other mineral, and only a trace of blende.

Output—

Locality.	Crushing.	Yield per ton.	Authority.
Pot-holes E.N.E. of shaft ...	15 tons brownstone	8 or 9 dwt.	Carmichael
Main shaft	? tons	13 dwt.	,,

Sailor Boy (M.L. 98).

Location.—The open cut on Norton Creek, in M.L. 98, is about 4 chains above Chandler's reef—1¼ mile south-south-east of the school.

Workings.—The workings consist of one opencut.

Reef.—The reef strikes W. 12° N., and dips 85° to north. It has been considered the continuation of the All Nations, but on insufficient evidence.

The country rock is a hard undecomposed granite, which on the footwall side is jointed parallel to the reef for 6 ft. from it. At 4 ft. 6 in. from the reef in the hanging-wall is a 6-ft. porphyry dyke.

Ore.—It consists of 3 in. calcite, with approximately 3 per cent. crystallised pyrite and 5 per cent. mispickel, laminated parallel to the walls.

Output—

Year.	Crushing.	Yield per ton.	Authority.
		Oz. dwt.	
1879	7 tons for 19 oz.	2 14¼	Carmichael
1881	8 tons for 12 oz. 12 dwt. ...	1 11½	,,
1883	3 tons for 9 oz.	3 0	,,

Partial total, 18 tons for 40 oz. 12 dwt. =2 oz. 5 dwt. per ton.

Scorpion.

Location.—About 5 chains north-north-east of the Sulphide, and about 1¼ mile south-south-east of the school-house.

Workings.—Two shafts and about 2 chains of trenching, now fallen in.

Reef.—Runs N. 40° W.

The country is decomposed granite.

Output—

Year.	Crushing	Yield per ton.	Authority.
		Oz. dwt.	
1879	15 tons for 23 oz. 3 dwt.	1 10¾	Carmichael
	20 tons for 14 oz 10 dwt.	0 14½	,,
1880	9 tons for 27 oz.	3 0	,,
	14 tons for 9 oz. 1 dwt.	0 13	,,
	9 tons for 10 oz.	1 2¼	,,
	5 tons for 2 oz.	0 8	,,
	6 tons for 5 oz. 3 dwt.	0 17¼	,,
	9 tons for 7 oz.	0 15½	,,
1881	12 tons for 9 oz. 3 dwt.	0 15¼	,,

Partial total, 99 tons for 107 oz. =1 oz. 1 dwt. per ton.

SMART'S (SULPHIDE COMPANY).

Location.—About 1½ miles S. 15° E. from the Post Office, and adjacent to Norton Creek on the west. It is now included within the Sulphide Company's claim.

Workings.—The opencut at the south-eastern end is only 1 chain from the creek. Smart's shaft is 2 chains to the north-west of the cut; Smart's second shaft, in which water is standing at 30 ft., is 1½ chains to the north-west of the first; and Smart's third shaft, 22 ft. deep and holding 15 ft. water, is 1 chain to the north-west of the second. (The last shaft is 5 chains E. 15° S. from the eastern shaft on the Sulphide line, with which it is connected by a line of trenches, as described under the "Sulphide.")

Reef.—The strike, according to the shafts, is N. 45° W., and the dip is to the south-west at 75°.

Smart's third shaft is on a big formation, which is less distinguishable in the other shafts. There does not appear to be any defined reef.

Ore.—At Smart's shaft only altered and slightly mineralised granite can be seen. Smart's second shaft was sunk on ironstained decomposed granite, probably originally having pyrite on the joint-planes. The prospectors got good prospects in Smart's third shaft, but a 10-ton trial gave only ½ oz. per ton, and the "ore cut out" into grey granite below. The gold presumably occurred in pyrite on the joint-planes. In the opencut only ironstains on the cracks in decomposed granite can be seen, and it was in these the gold was found.

Remarks.—About 2 chains south-west of the third shaft the granite beside a diorite dyke (2 ft. wide) is ferruginous, and a 10-dwt. crushing is reported from it.

SPOTTED GUM (G.M.L. 104).

Location.—Lies S. 27° E. from Marodian main shaft about 5 chains. The reef was first opened 30 years ago. It is now included within M.L. 104.

Workings.—The shaft is 90 ft. deep (water now at 40 ft.), and the reef has been stoped and trenched for 40 ft. to north-west and for 1½ chains to south-east.

Reef.—The strike is N. 50° W., vertical.

The reef is reported to be 9 to 12 in. wide; and 4 in. have been left standing at one place on the surface.

A small branch vein on the north has been opened east of the shaft.

Ore.—The ore is quartz in which the fissure is central.

Output—

Year.	Crushing.	Yield per ton.	Authority.
		Oz. dwt.	
1879	15 tons for 23 oz.	1 10¾	Carmichael
	14½ tons for 15 oz.	1 0¾	,,
1880	2 tons for 3 oz. 12 dwt.	1 16	,,
1881	16 tons for 16 oz. 7 dwt.	1 0½	,,

Partial total, 47½ tons for 57 oz. 19 dwt. = 1 oz. 4 dwt. per ton.

SULPHIDE.

Location.—The main shaft is 5 chains west of Norton Creek, about ¼ mile north of 1v, Milton, and 1½ miles S. 15° E. from the Post Office.

The claim has been idle (under exemption) since the end of 1905, for want of capital, and is now apparently abandoned.

Workings.—McDonnell's shaft, 47 ft. deep, was begun two years ago; from the bottom a drive runs 30 ft. south. Halfway along it a winze was sunk 42 ft., and from the bottom of the winze drives have been opened 40 ft. north-west and south-east. Owing to the foul air at 25 ft. below the surface, it was impossible to inspect these workings, but it is understood that some stoping has been done above the 47-ft. level.

The eastern shaft, 20 ft. deep, is 2½ chains south-east of McDonnell's.

Within 2 chains south-west of McDonnell's shaft there are four parallel trenches.

A line of trenches, 10 ft. deep, ½ chain long, and ½ chain apart, connect the eastern shaft and Smart's third shaft, elsewhere referred to.

Reef.—The Sulphide lode runs N. 45° W., dipping 1 in 6 to the north-east at the shaft bottom, but almost vertical in the winze.

The reef is 4 ft. wide in the stopes south of the main shaft, but on the 47-ft. level at 29 ft. south of the shaft it pinched to 3 in. The south-eastern drive on the 89-ft. level for 15 ft. followed a ¼-in. leader, then, opening out to 8 in. of black sulphides (sent to Cockle Creek), with 18 in. "spar" between the lode and the footwall.

The reef in the eastern shaft was 15 in. wide at the surface.

Ore.—The ore is an altered granite, in which granular white quartz, pyrophyllite and sericite (?) can be distinguished. It contains veins of quartz and mispickel (say 20 per cent.), rendering the rock in some places a perfect stockwork, while in others the granite has been wholly replaced. The blende in parts amounts to 5 per cent. That the gold occurs chiefly in the sulphides has been proved by crushings, yielding only 14 dwt. per ton, while the concentrates contained 4 oz. The coarsely crystallised mundic has been found to be comparatively poor—15 dwt. gold per ton.

In my sample (98) from the 7 tons of "seconds" at grass (from which probably an equal amount of mullock had been removed), the ore—replaced shattered granite—consists of:—

1. Quartz and pyrophyllite (75 per cent.)—quartz original and secondary with pyrite.
2. Mispickel (10 per cent.)—disseminated in quartz.
3. Pyrite (10 per cent.)—crystallised in quartz, much leached.
4. Blende (5 per cent.)—bunches among pyrite masses and also filling interspaces in quartz.
5. Chalcopyrite (trace)—filling interspaces in quartz and blende.

Order of deposition: (i.) Mispickel, (ii.) pyrite, (iii.) quartz, (iv.) blende, (v.) chalcopyrite.

Assay (Government Analyst):—

Gold = 1 oz. 8 dwt. per ton.
Silver = 2 oz. 7 dwt. 4 gr. per ton.

Analysis (Government Analyst)—not expected to be available for some months. Only 3 per cent. zinc is shown in the above rough estimation.

Output—

Claim.	Crushing.	Yield per ton.	Authority.
Main shaft ...	10 tons yielded 2½ tons concentrates*		
	Samples of the concentrates have yielded gold	3 oz. 5 dwt. to 4 oz. 5 dwt.	McDonnell
	and silver	15 oz.	
	3 tons yielded 16 cwt. concentrates and 3 oz. 8 dwt. gold	1 oz. 2 dwt.	,,
	3 tons brownstone paddocked are expected to yield	14 dwt.	Carmichael
Eastern shaft	6 tons brownstone yielded	12 dwt.	,,

* These concentrates have been sent to Cockle Creek, but the returns are not yet available to me.

Remarks.—The trenches south of the main Sulphide shaft are on bunches of ore ("formation" or "stone reef"), all of which were rich in scorodite. The work done indicates very short rich shoots at frequent intervals. One trench, 2 chains south of the shaft, runs E. 30° S. The reef can be seen in another trench 15 ft. south of this to be 6 in. wide. A big porphyritic dyke, 2 chains north of the Sulphide shaft, runs E. 15° N.

Welcome.

Location.—1⅛ mile south of the school-house. McDonnell's is the only claim now held on this line.

Workings.—These comprise old trenches and pot-holes at the eastern end, and several shafts about 20 ft. deep. McDonnell's shaft, 23 ft. deep, having been just cleaned out, was inspected. About 5 chains to the west of McDonnell's are two or three very old pot-holes on the same line.

Reef.—The strike is east and west and the dip is south about 80°. At the eastern end only 9 in. "formation" is visible, but there is some quartz at the western end.

Ore.—Very little ore of any kind can be seen on the surface, or in McDonnell's shaft either, though the claimholders stated that they were re-opening the shaft because they had found some mundic in stone from it.

Output—

Year.	Crushing.	Yield per ton.	Authority.
		Dwt.	
1879	14 tons for 8 oz. 8 dwt.	12	Carmichael
	3½ tons for 2 oz. 10 dwt.	14¼	,,
1880	25 tons for 8 oz. 8 dwt.	6¾	,,
	24½ tons for 14 oz. 10 dwt.	11¾	,,

Partial total, 67 tons for 33 oz. 16 dwt. = 10 dwt. per ton.

Who'd-ha'-Thought-It (G.M.L. 104).

Location.—In the north-eastern part of G.M.L. 104, of 40 acres, about 4 chains south-east of the Post Office. The workings are among the oldest on the field, and the plant includes a 14-h.p. winding engine. The lease was under three months' exemption from the beginning of December, 1905.

Workings.—The main Marodian shaft, 320 ft. deep, lies S. 31° W. four chains from the north-eastern corner of the lease. The shaft was cleaned out to 200 ft. depth by the Marodian Company, but since they ceased operations it has filled with water to within 40 ft. of the surface.

The western shaft is 1½ chains to the west of the main shaft, and an opencut extends for two chains to the east of the same.

Reef.—The reef runs E. 12° N., and is vertical.

Its thickness is only from 1 to 3 in.; it is therefore generally referred to as the Who'd-ha'-Thought-It leader, and mining costs have always been excessive.

Between the 200 and 290-ft. levels the leader lay in contact with the Marodian reef, and at the latter level pinched out altogether. It was also lost on the surface about 2 chains east of the main shaft.

"The shoots of ore have a westerly direction" (Rands).

The country is granite. At 200 ft. below the surface a dyke (decomposed, and pyritous near the reef) runs down to the reef, and follows it to the shaft bottom.

Ore.—Of the ore at the brace one-half is calcite, the remainder being quartz and crystallised pyrite, blende, and galena. It has been very rich in gold, carrying, it is said, 3 oz., with 12 oz. silver, per ton. Mr. Rands stated that it "averaged 8 to 10 oz. per ton, and in parts has gone as much as 20 oz. per ton." The value of the gold is £3 per oz.

In my sample (101) from the 200-ft. level, at grass, the ore, with quartz pyrophyllite country, consists of:—

1. Calcite (50 per cent.)—bluish and brownish veins and also filling interspaces of dogtooth quartz.
2. Quartz (20 per cent.)—glassy veins.
3. Pyrite (15 per cent.)—crystals in quartz and in silicified country, also some later than the quartz, as rounded crystals and grains.
4. Blende (10 per cent.)—crystals in quartz, in calcite (scarce) and in pyrite.
5. Galena (5 per cent.)—massive between quartz layers and country, and also in pyrite interspaces.
6. Mispickel(?) (traces)—fine-grained mineral in a cross crack.

Order of deposition: (i.) blende, (ii.) pyrite, (iii.) galena, (iv.) quartz, (v.) calcite, (vi.) mispickel (?).

Assay (Government Analyst): —

Gold = 5 oz. 10 dwt. 9 gr. per ton.
Silver = 6 oz. 9 dwt. 14 gr. per ton.

Analysis (Government Analyst)—not expected to be available for some months. The above rough estimation shows the presence of zinc = 6½ per cent. and lead = 4 per cent.

Output—

Claim.	Year.	Crushing.	Material.	Yield per ton.	Authority.
				Oz. dwt.	
	1879	11 tons for 308 oz. ...	...	28 0	Carmichael
Hickey's ...	1879	9 tons for 12 oz. ...	...	1 6¾	,,
	1880	4 tons for 6 oz. 19 dwt.	...	1 14¾	,,
	1880	7¾ tons for 167 oz. 11 dwt.	...	21 12¼	,,
		Crushings yielding ...	...	25 0	Warden
		10½ tons for 32 oz. 10 dwt.	Screenings ..	3 2	Carmichael
		3½$\frac{3}{10}$ tons for 17 oz. 4 dwt.	Tailings ...	4 4¼	,,
	1881	6 tons for 26 oz. 12 dwt.	...	4 8¾	,,
	1882	9 tons for 90 oz. 10 dwt.	...	10 1	,,
		7 tons for 140 oz. ...	...	20 0	,,
Main shaft, 300 ft.	...	50 tons for 150 oz. ...	...	3 0	,,
		½ ton for 18 oz. 15 dwt.	From tip ..	37 10	,,
		2½ tons for 8 oz. ...	Tailings ...	3 4	,,
		9 tons for 68 oz 10 dwt.	...	7 12¼	,,
	1885	16¾ tons for 48 oz. 19 dwt.	..	3 0	Rands
	1886	6 tons for 47 oz ...	...	7 16¾	Carmichael
	1894	4 tons for 36 oz 10 dwt	Headings ..	9 2½	Warden
	1902	5½ tons for 6 oz. 10 dwt.	...	1 3½	,
	1903	77 tons for 223 oz.	Oxidised, 1½ oz. Sulphide, 3 oz.	2 18	,,
	1905	50 tons at grass	...	...	Manager
		10 tons returned 6½ oz. gold	...	0 12½	
		½ ton 3 oz.	Concentrates ...	1½	
			Tailings ...	0 19	
				3 1½	

Partial total, 249 tons for 1,440 oz. 5 dwt. = 5 oz. 16 dwt. per ton.

OUTPUT.

The returns as given below, and in the descriptions of the various reefs, must be acknowledged to be fragmentary. The total annual yields have been compiled chiefly from the Warden's annual reports, which, unfortunately, have been published only since 1878, whereas gold was discovered here seven years previously. Most of the yields of individual reefs were obtained from Mr. Carmichael, of Norton, whose records, however, are incomplete, while his crushings began only in 1879, in which year he erected his battery on the field. A few of the early returns are given in Mr. Rand's report, and some of the latest have been sent me by Captain Osborne.

OUTPUT OF NORTON FIELD, 1878 TO 1905.

Year.	Material.	Amount.	Treatment.	Total yield.	Yield per ton.	Value per oz.	Authority
		Tons.		Oz. dwt.	Oz. dwt. gr	£ s. d.	
1878	...	222	Crushed ...	956 16 =	4 6 0	..	Warden
1879 1880	..	1,849	...	3,662 10 =	1 19½ 0	...	„
1881	...	200	...	301 0 =	1 10 0	...	Carmich'l
1882	..	285	...	876 0 =	3 1½ 0	...	„
1883	...	11	...	15 0 =	1 7 0	..	„
1871 to 1884	...	2,766	...	7,883 0 =	2 17 0		Rands
1886	..	70	Chlorinated	210 0 =	3 0 0	...	Warden
1887	...	1,000	„	2,553 5 =	2 11 0	4 3 0	„
1888	...	?	„	3,702 0	...	4 3 6	„
	...	8	„	29 0 =	3 12½ 0	...	„
1889	...	70	„	?	...	...	„
1891	..	1,775	Crushed	186 0 =	0 2 5	...	„
1892	...	$617\frac{15}{20}$	„	240 13½=	0 7¾ 0	...	„
1893	...	$695\frac{5}{20}$	„	132 3 =	0 4 0	3 0 0	„
1894	Headings	4	„	36 10 =	9 2 0	...	„
	Surface ..	1,353	„	180 14 =	0 2 16	3 0 0	„
1895	...	708	„	78 6 =	0 2 5	3 0 0	„
1896	..	46	„	21 18 =	0 12 12	3 0 0	„
	Concentra's	22	...	20 5 =	0 18 9	...	„
1900 and previous years	Tailings and headings from shafts	3,046	...	613 11½=	0 4 3	...	„
	...	80	...	45 0 =	0 11 6	...	„
1902	...	23½	...	40 0 =	1 14 0	...	„
1903	...	77	...	223 0 =	2 18 0	...	„
1904	...	145	Crushed	65 4½=	0 9 0	...	„
	Concentra's	$132\frac{5}{20}$	„	329 7¼=	2 10 0	...	„
1905	...	$93\frac{12}{20}$	„	79 15½=	0 17 0	...	„
1905	...	$79\frac{5}{20}$	Treated ...	143 3½=	1 16 0	...	„
	Concentra's	$1\frac{15}{20}$		4 2 =	2 7 0	...	„
Partial total	...	12,814	..	16,690 18¾=	1 6 0		

TREATMENT.

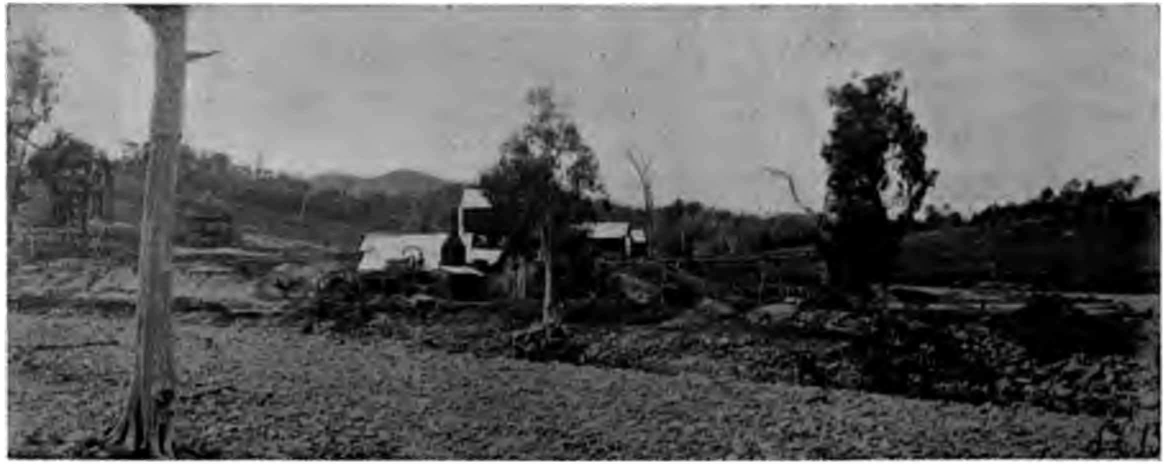
The aim at Norton has hitherto been to save only gold and silver, but should the ore available be proved sufficient in quantity to warrant the expenditure on plant, any combinations of the processes offered below might be worthy of consideration, in order that the zinc, lead, and copper might also be saved.

The demand for zinc is not likely to show any falling off, and as the mines of Joplin, Missouri (one of the world's largest producers), are showing signs of depletion, the price is not expected to fall. Large supplies are now being secured in the western United States, these having hitherto been neglected owing to their- complex character, while the poorer eastern ores were available. The consequence is, that methods of treatment are being devised, and electro-magnetic separation is receiving a thorough trial.

SMELTING.

Owing to the difficulties and consequent high cost of smelting, impurities in zinc ores are especially objectionable, and zinc in excess

Plate IV.



CARMICHAEL'S BATTERY AND WATER-JACKET SMELTER, NORTON. [*L. C. B., photo.*

ɜr cent. is looked upon with considerable disfavour by the copper ad smelter, though some metallurgists affirm that up to 10 per ıf zinc can be successfully slagged off.

Bartlett Process.

'evertheless, a special process has been used at the Bartlett ;, Colorado,* which is an extreme case of pyritic smelting, two ıf tuyeres being in use in the blast furnace to cause rapid oxida- nd volatilisation of the lead and zinc, and the formation of gold ilver bearing copper matte. It is specially applicable to ores ning a mixture of lead and zinc (especially over 20 per cent. of tter), with but little copper. The only disadvantage appears to › high loss of silver (6 to 15 per cent.) in the lead-zinc fumes, are condensed to form pigment. Fuel costs may, however, be erable.

Water-jacket Blast Furnace at Norton.

[r. Carmichael some months ago erected a water-jacket blast e adjacent to his battery, with the intention of smelting the n ores, but he found it impossible to economically put the ɜs through it, owing to the presence of zinc in the ore. The al section at the tuyeres is 3 ft. 10 in. by 1 ft. 6 in., and the ty of the smelter is 30 tons a day. The castings were made in and Twigg's Rockhampton foundry, and the total cost of the e, with Gunter blower, was £700.

'or the purpose of testing the various ores brought to him, Mr. chael designed an experimental furnace, which is worth describ- A 6-gallon oil drum forms the outer wall of the furnace, and a vay boiler tube, inside it, the inner wall, a current of water g in the space between the two. A pipe at the base of the vay tube is used for the blast, and a spout conducts the molten ial out at the opposite side.

WASHING.

is important generally to separate the sulphides prior to smelt- ad the cheapest way, when it is possible, is by washing after g. By the use of the jig (as at Joplin), vanner, shaking table, ussion table, there should be no difficulty in separating the (specific gravity = 7·5), from the pyrite (sp. gr. = 5), blende = 4), and chalcopyrite (sp. gr. = 4·2), and at the same time rid of the calcite (sp. gr. = 2·7) and quartz (sp. gr. = 2·6). ena might then go direct to the smelter, but the pyrite-blende- yrite "middlings" would require further treatment by magnetic or.

---

* "Matte Smelting." H. Lang.

Battery Treatment and Concentration at Norton.

At the present time there are two stamper batteries at Norton—Carmichael's ten-head (of which five are out of commission), and Todman's three-head. Carmichael is now making a very clean separation of the sulphides from gangue on a percussion table of extremely elementary design. The table is built of eight flooring boards, 8 ft. in length with four equidistant crossboards as stays. The ram, 3 in. by 2 in., and 6 in. long, is let into another flooring board attached to the cross stays. This is pressed against an ordinary buggy spring by a 5-in. cam, revolving at such a rate that the table receives two throws per second. The surface of the table is furnished with undercut riffles ¼-in. high, ¾-in. wide, and 1 in. apart; and the cant of the whole surface is 2 in. from back to front, and ½-in. from feed end to discharge end. The table is swung from overhead beams by ½-in. rods, fitted at the upper ends with regulating nuts. The total cost of timber and nails required is only 15s., and the machine can be fitted up by any carpenter and mechanic.

MAGNETIC SEPARATION.

Magnetic separation is employed generally for minerals of like specific gravity—*e.g.*, blende, pyrite, chalcopyrite, &c.—from which the relatively lighter or heavier minerals may have been previously removed on jigs, vanners, or tables. Artificial magnetism is sometimes produced in sulphides and oxides by a rapid roast.

Magnetic separators have been classed* as follows:—

I. Ore on conveying belts passing the magnetic field; Conkling Wetherill,† (1½ to 30 tons per hour), Chase, Hoffman Kessler, Rowland (2 tons per hour), Ball-Norton, Heath Odling,‡ Heberli wet, Edison fine, &c.

II. Ore-falling on a rotating cylindrical drum, within which ar magnets: Ball-Norton, Monarch (1¼ tons per hour) Heberli, Ferraris, Siemens and Halske (1 to 1½ tons pe hour); Wenstrom (5 tons per hour); Buchanan (6 ton per hour); Sautter (4 to 5 tons an hour); Siemens (1 to per hour); Payne, Imperial, Langguth, &c.

III. Ore falling vertically past magnets: Edison (16 tons pe hour); Heberli, Dellvick-Gröndal,§ Rowland (2 tons pe hour); Hedburg, Mechenich,‖ Snyder,¶ Ullrich** (2 ton per hour).

IV. Ore separated by repulsion and use of static electricity Blake-Morscher†† (½-ton per hour); Pickard (Wynne).

---

* See "Ore Dressing." By Robert H. Rickards.

† Coming into use in the Silesian zinc mills.

‡ Designed at the Pinnacles Mine, Broken Hill, N.S.W.

§ Used for Swedish iron ores.

‖ Successfully operated in Silesian mills, and at the Central Mine, Broken Hill.

¶ Used at Leadville, Colo., U.S.A.

** Used at the Australian Metal Works, Broken Hill.

†† Used in Wisconsin, U.S.A.

It is held that the third class should theoretically give the most economical results, but that this is not altogether sustained in practice is proved by the successful operation of machines belonging to the other classes. There are now, in fact, so many types that it would be unwise to make a selection of any without first having thoroughly investigated the claims and performances of all the different types in use. One, for instance, that has been designed for the separation of a highly magnetic mineral from a non-magnetic should not be expected to give satisfaction in the separation of minerals of similar magnetic attractibility.

Treatment at Leadville, Colorado.

The Leadville ore has the following composition:—*

Zn = 24%; Fe = 25%; Pb = 6%; SiO_2 = 4%; and Ag = 8 oz. per ton.

It is first passed over Wilfley tables, and then through magnetic concentrators, and these are the results:—

The Wilfley concentrates, worth £2 per ton, and amounting to 36 per cent., contain—

Zn = 38%; Fe = 17%; Pb = 2·5%; SiO_2 = 4%; and Ag = 4 oz. per ton.

The Wilfley middlings, worth £1 13s. per ton, and amounting to 38 per cent., contain—

Zn = 11%; Fe = 28%; Pb = 16%; SiO_2 = 3%; and Ag = 9 oz. per ton.

The magnetic separator concentrates, worth £3 12s. per ton, and amounting to 29 per cent., contain—

Zn = 50%; Fe = 7%; Pb = 1%; SiO_2 = 6%; and Ag = $3\frac{1}{2}$ oz. per ton; value, £3 12s. p. ton

The magnetic separator middlings (49 per cent.), worth £1 10s. per ton, contain—

Zn = 8%; Fe = 35%; Pb = 9%; SiO_2 = 2%; and Ag = 11 oz. per ton.

Treatment in Virginia.

At a mine in Virginia† the ore is jigged, and the concentrates containing—

Zn = 7%; Fe = 5%; Pb = 65%—

are sent to the smelter, while the middlings go to the magnetic separator, which produces zinc concentrates containing—

Zn = 44%; Fe = 5%; Pb = 1·5%

OIL CONCENTRATION.

In the Elmore process the finely ground ore is agitated in special vessels, with a layer of oil. Certain sulphides, being wetted and adhered to by the oil, will be collected in it, and may thus be separated from some others, and most of the gangue minerals. For instance, it is possible to separate gold, silver, copper pyrite, grey ore, stibnite, galena, &c., from blende, &c.

---

* W. R. Ingalls, "Engineering and Mining Journal," 19th August, 1905.

† E. Higgins, "Engineering and Mining Journal," 30th March, 1905, and 6th April, 1905.

LEACHING.

Danziger's process was designed for low-grade ores containing pyrite and blende. The ore is roasted to form ferrous sulphate, which is leached out, leaving the blende more or less free from iron, and in a better condition for smelting.

CHLORINATION.

Former Treatment at Norton.

Chlorination has in the past been successfully carried out at Norton, the Frampton United Company having in 1886 erected a barrel chlorination plant and five reverberatory furnaces, of a capacity of 60 tons a week, at a cost of £3,000. The furnaces were kept supplied by ten head of stampers, a dry crusher, installed at a cost of £800 in 1888, proving a failure. These chlorination works were suddenly shut down in 1891, for reasons of which there are no records, but possibly because of a change in the composition of the ore mined, such as an increase in the amount of zinc, copper, and lime, all of which, as oxides, absorb chlorine, and may prevent the application of the process. The copper might, however, be leached out after the roast, and the lime, if present in relatively small amounts, could be first neutralised by acid.

A roasting and chlorination plant was erected here in 1889 by the Advance Company, but work at it was abandoned in the following year, after an unsuccessful attempt to treat 70 tons of ore. The non-success of the process in this case was in all probability due to the large amount of calcite in the ore.

Still another attempt was made at chlorination by Mr. Carmichael in 1895, but it would appear, like the others, to have failed.

Treatment at Cassilis, Victoria.

An example of the successful application of the process to a somewhat similar ore is to be found at Cassilis,* in Victoria, where the ore contained 10 oz. per ton at the surface, but suffered a rapid fall in value in the refractory sulphides (mispickel, pyrite, blende, and 7 per cent. galena, with siderite, and less than 1 per cent. each of antimony, manganese, copper, and tin). The proposition here was to save only gold, silver, and lead, and, therefore, though experiments in magnetic separation were carried out, the method in use consists in the separation of galena and copper ore on Wilfley tables after hydraulic classification. The galena concentrates are then shipped to smelters, the pyritic concentrates (15 to 20 per cent.) are chlorinated after roasting, and the tailings are cyanided. The following items of cost are interesting:—

---

* "Engineering and Mining Journal," 29th July, 1905.

	£	s.	d.		
Mining development and transport	0	15	8	per ton	crushed
Milling	0	4	10	,,	,,
Roasting (Edwards's Mechanical Furnace) ...	0	10	5	,,	,,
Chlorination	0	9	3	,,	,,
Cyaniding	0	3	0	,,	,,
Shipment and smelting	0	1	9	,,	,,
	£2	4	11	,,	,,

FUTURE PROSPECTS.

The future of the goldfield depends, firstly, on proving or indicating the existence of ore in some quantity in the ground; and, secondly, on the selection of a suitable method of concentrating the ores.

With regard to the former, 28 lines of reef have been described above. They are generally less than 12 in. in thickness, but in exceptional cases reach 3 ft., and even more. Unfortunately, only a few of the reefs could be examined in the working places by me, owing to the general suspension of operations on the field. Much of the information given is chiefly hearsay, on which, of course, implicit reliance cannot be placed.

Mr. Rands, in his 1885 report states, after inspecting the then working mines, that "auriferous pyrites ores undoubtedly exist here in large quantities."

The Norton reefs have hitherto been worked almost solely for their gold and silver contents, and the returns would, but for the complex sulphides in the ore, have returned a profit. I am of opinion that if a method of treating these sulphides were brought forward, and a plant put into operation on the field for the saving of all the metallic values, many reefs, hitherto neglected because of their poverty in gold, would be opened up. I further consider that the reefs discovered at Norton amount to only a fraction of those on intervening joint planes overlooked in prospecting owing to their low gold and silver contents.

Brisbane, 17th May, 1906.

By Authority: George Arthur Vaughan, Government Printer William street, Brisbane.

Queensland.

DEPARTMENT OF MINES.

Geological Survey of Queensland.
PUBLICATION No. 209.

SOME GOLDFIELDS

OF THE

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BY

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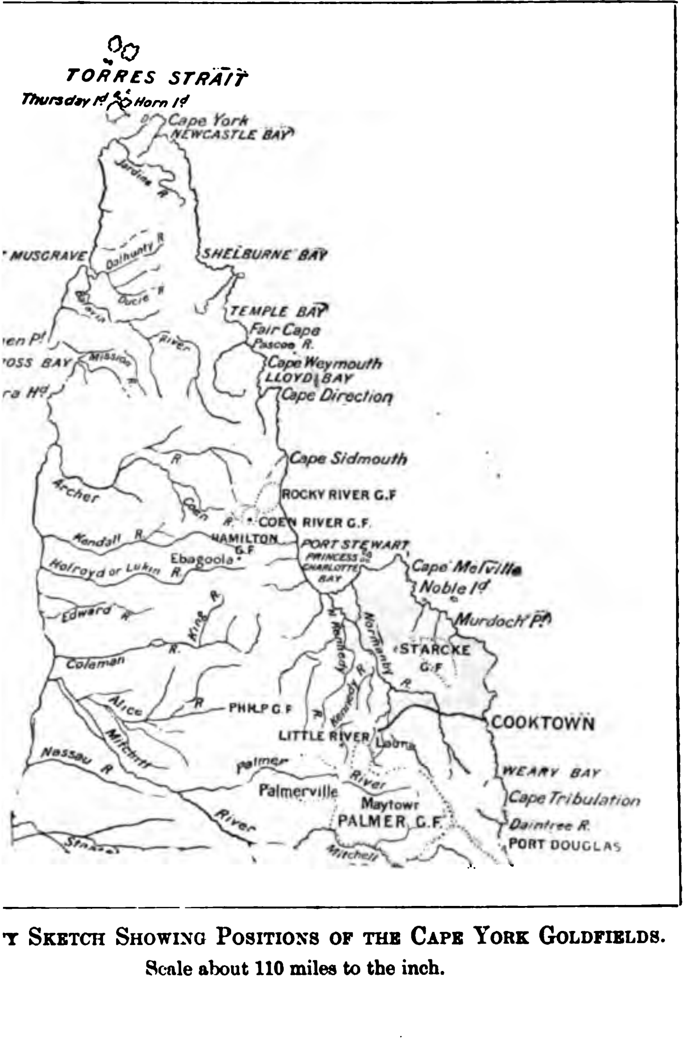
GOLDFIELDS OF THE CAPE YORK PENINSULA.

I.—THE STARCKE GOLDFIELD.

Starcke Goldfield occupies an area of about 60 square miles, the Normanby River and the east coast, about 40 miles north-t of Cooktown. Gold was first found in this district in 1890, d of which year 230 men were working alluvial along the



Y Sketch Showing Positions of the Cape York Goldfields.

Scale about 110 miles to the inch.

gullies at the head of a river supposed to be the Starcke. The Starcke River proper, however, was discovered and named by Dr. Jack in his trip from Cooktown to the Coen River in 1879, and lies about ten miles further to the west, entering the sea to the north-west of Murdoch Point, in which position it is mapped on all the colony maps as yet issued.

During the six years, 1890 to 1895, some 2,351 oz. of gold, worth about £4 per oz., are recorded as having been obtained from the gullies forming the head of the eastern branch of the river above referred to. This locality is now known as the Old Starcke, and has been abandoned since 1895. Attempts were made to prospect several veins by sinking shafts and by tunnelling to meet them at greater depths, but in no case were any payable reefs discovered.

In 1892, gold in association with antimony and quartz was found on Cocoa Creek, a tributary of the McIvor River, and was worked successfully for about five years, returning in that time 1,108 oz. of gold bullion, reported as worth £3 18s. per oz., the greater portion coming from the ore vein found in a claim known as the First Call. The workings have been idle since 1896, but the ground has been recently taken up by an English syndicate, who propose continuing the work with a view to recovering the antimony as well as the gold.

In 1896, alluvial gold was discovered at a locality five miles further down the river from the Old Starcke Camp, and about eight miles by road from the mouth. This locality is now known as Munburra. During the three years, 1896-1898, 1,479 oz. of alluvial gold are reported to have been obtained here, and the alluvial appears then to have become worked out. In the latter year, however, reefs were located and reward claims granted on the Last Hit and Monte Carlo reefs, and a two-head stamper battery was erected. A second small battery was introduced in the following year, and from then till the end of last year the field had returned some 7,666 oz. of gold from 3,293 tons of stone.

At the time of my visit in May last, work was being carried on at only three of the smaller reefs, trouble with water having necessitated the abandonment of the majority of the shafts pending the introduction of pumping machinery to cope with it.

COCOA CREEK GOLD AND ANTIMONY REEFS.

The only reef that has been mined to any extent in this locality is in the First Call Mine. The country rock is composed of slates and sandstone, striking north and south, and standing nearly vertical. The lode runs east and west in slates, and is almost vertical, underlying slightly to the south. The shoot of ore, composed of quartz carrying a large quantity of stibnite (antimony sulphide), is about 120 ft. in length, and is reported by the owners to have been worked down to a depth of about 150 ft. by means of two shafts sunk from the outcrop, about 100 ft. apart. These shafts are connected by a level at the bottom, and all the pay ore, except a width of about 15 ft. above the 150-ft. level, has been mined and crushed. The lode in the bottom is said to average about 1 ft. 6 in. in thickness; but, as the shafts had been in disuse since 1897, the mine could not be inspected. On its eastern end the shoot of good ore breaks up on the surface into a number of small leaders of quartz as it passes into a belt of sandstone. Several of these have been prospected by shallow holes, but without much success.

The following are the returns, as given in the Annual Reports of the Department of Mines, of stone crushed and gold obtained from the Cocoa Creek reefs during the five years that they were working. Most of this stone came from the First Call Mine, though several small lots were from other reefs in the neighbourhood:—

RETURNS FROM COCOA CREEK REEFS.

	Stone Crushed.	Gold Returned.
	Tons.	Oz.
1892	16	41
1893	367	352
1894	561	539
1895	174	138
1896	21	38
	1,139	1,108

As the value of the gold is recorded as averaging about £3 18s. per oz., this gives a total value for the 150 ft. of sinking of about £4,321, and an average value for the stone of about £3 16s. per ton. This takes no account of the amount of gold lost in the tailings, which, on account of the nature of the ore and the crude dressing appliances used, was probably considerable; nor of the value of the antimony, of the percentage of which there is no record.

The Munburra Reefs.

The reefs in the neighbourhood of Munburra occur in altered sedimentary rocks, made up of slates, quartz-schists, and quartzites, with a general meridianal strike and very steep dips to east or west. The greater number lie close to two parallel dykes of porphyry, which also have a north and south strike. The western dyke, which is the more prominent of the two, can be traced from Munburra Creek, near the township, to the seaward slope of the coast range, about three miles further north. The second dyke lies about a mile further to the east. The reefs strike for the most part at right angles to these dykes, and to the strike of the slates and schists, though a few, on the other hand, appear to conform to the bedding of the slates and schists.

The following table gives the annual return of reef gold from the Munburra reefs from 1898 to 1905:—

RETURNS FROM MUNBURRA REEFS.

	Stone Crushed.		Gold Returned.	
	Tons	cwt.	Oz.	dwt.
1898	76	0	930	0
1899	1,222	0	2,644	0
1900	667	0	907	0
1901	283	0	1,070	0
1902	528	0	1,267	10
1903	278	5	501	0
1904	181	10	273	0
1905	58	0	74	1
	3,293	15	7,666	11

The rapid falling off in returns since 1902 is accounted for by the fact that, notwithstanding the rich value of the stone crushed from above the water-level, averaging some £9 5s. per ton, no reserves were formed for the purpose of coping with the water when it was met with, and of carrying on economical mining under the more arduous conditions involved in increasing depths.

The Boomerang Reef.

The Boomerang reef lies on the eastern side of the western dyke of porphyry referred to above, about half a mile north of Munburra. The P.C. shaft is situated about 40 ft. from the wall of the dyke, and has been sunk to a depth of about 80 ft. The reef was driven on at the water-level (55 ft. down) to north and south, and the ore stoped out to the surface over a length of about 60 ft.

According to the mill returns, 166 tons of stone were crushed from this shaft during the years 1898 to 1904 for a return of 839 oz. 1 dwt. of gold. The value of the gold is given as about £3 17s. per oz., which would give a total value of £3,230, and an average value of the stone of over £19 per ton.*

The last crushings were taken out by a company called the Queen Alexandra Company, working during the years 1902-1904, when they sank the shaft from the 35-ft. level to the bottom, and raised 118† tons of stone, which returned them 342 oz. 8 dwt. of gold.

From the amount of stone crushed from this shaft, it may be inferred that the reef averaged about 1 ft. in thickness. The shaft is 7 ft. by 4 ft. 6 in., timbered, and in good order to the 55-ft. level. The Queen Alexandra Company installed an 8-h.p. vertical boiler and pump, with a 2-inch outlet pipe, but were not able to cope with the water, and the enterprise was given up. It was impossible to get down the shaft and examine the sink without unwatering it.

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* Inadvertently printed as £9 in "Mining Journal," December, 1906.

† Inadvertently given as 166 tons in "Mining Journal," December, 1906.

About 200 ft. east of the P.C. shaft, and a little to the north of the line, several shafts have been sunk on a parallel reef to depths of about 60 ft., and over a length of about 100 ft. From these shafts, situated on the No. 1 and No. 2 East Boomerang claims, 241 tons of stone appear to have been raised, for a return of about 1,177 oz., of a value of £4,532 15s. This gives an average value for the stone crushed of over £18 per ton, and, notwithstanding the apparently small size of the reef (judging from the small amount of stone raised) the high quality of this stone should make this reef worth further development.

According to the Warden's records, the total amount of stone from the Boomerang reefs was 529 tons 3 cwt., returning 2,393 oz. 12 dwt. 14 gr. of gold, of a value of about £9,214, thus giving an average value for the stone of over £17 per ton.

Last Hit Reef.

On the Last Hit reef, a shoot of ore, apparently about 150 ft. in length, was worked down to the water-level (about 50 ft.) by three shafts in the P.C. and No. 1 West claims. The water was met at this depth, and proved too much to allow of further sinking without installing pumps or steam winding gear. The workings to the east were bounded by a fault, beyond which a white barren reef is reported to have been picked up and driven on for 30 ft. To the west of the No. 1 West shaft the reef is reported to have split up into several leaders.

About 250 ft. east of these workings, and about 40 ft. up the rise of the hill, a second shaft was sunk, near the eastern boundary of the P.C. claim, to a depth of 95 ft.; and a shoot of stone, about 40 ft. long, was worked out down to that depth. This shoot is reported to have split up, going west into several leaders; and to have cut out against several leaders (carrying rich gold near the junction) on the eastern end. The total crushings from the P.C. and No. 1 West claims amount to 1,223 tons for 2,930 oz., worth about £11,720. From the work done, this indicates a reef averaging 1 ft. 6 in. throughout, and worth over £9 per ton. It is impossible to say what the ore below the water-level is worth, as the shafts could not be descended. A sample of mundic ore, taken from a small heap on the surface lying near the middle shaft of the P.C. claim, and said to have come from the 50-ft. level, gave a return of 1 oz. 12 dwt. of gold and 5 dwt. of silver, representing a value of over £6 per ton. This sample, though not up to the average of the returns from the brown stone, should, if it occurs for the whole length of the shoot of 150 ft., be well worth further development.

The Gladstone Reef.

About four miles north of Munburra, on the road to the landing at the mouth of the river, is the Gladstone Mine. Here a tunnel, going west into the side of a hill about 60 ft. below the crown, met the eastern end of a shoot of stone about 40 ft. in length, which had been worked down from the cap of the ridge. The reef cuts across north and south, striking micaceous schist and sandstone, with a dyke of porphyry following the bedding in the middle of the shoot of stone. A winze has been sunk 70 ft. below the tunnel level, and a drive put in 40 ft. west from the bottom.

A second winze was then put down on the ore to a further depth of 50 ft. The stone has been stoped out on the west side of this winze for about 12 ft. in, and still shows a seam of 4 in. of quartz on the hanging-wall, with about 3 ft. of greywacke interspersed with quartz veins on the footwall. A sample from this face gave only 1 dwt. 9 gr. gold per ton and 1 dwt. 19 gr. silver per ton. About 250 tons of stone have been crushed from this mine, for a return of 376 oz. 1 dwt. of gold.

Besides these three main reefs, a number of smaller lines, most of them connected with the eastern dyke of porphyry, have returned varying quantities of gold. None of these, however, have been very prolific, and, as little or no work was being done on them, it was difficult to get any accurate information concerning them.

II.—THE ALICE RIVER (PHILP) GOLDFIELD.

This field lies about 80 miles a few points north of west from Laura, the terminus of the Cooktown Railway. Gold was discovered in the reefs here by Prospector Dickie in 1904, and about 157 oz. were dollied before the end of the year. During 1905, 581 tons were crushed, for a return of 823 oz. 15 dwt. 6 gr., valued at £2,632 12s., and, during 1906, 541 tons for 586 oz. 9 dwt., valued at £1,876 12s., making a total of 1,122 tons of stone of an average value of £4 per ton.

The field can now be reached by buckboard coach, running fortnightly from Laura. For the first 60 miles the road passes over heavy sandy country, the result of the weathering of upper cretaceous sandstones, crossing the heads of numerous tributaries of the North Kennedy and Normanby Rivers, flowing to the east coast. These streams gave water at the time of year when the writer visited the field (end of June), at stages of from eight to twelve miles, notwithstanding the poor season. During the latter half of the year, however, the track becomes very dry. About 64 miles from Laura the divide between the eastern waters and the head of the Alice River, which flows into the Gulf of Carpentaria, is passed over, but is almost imperceptible to an unobservant traveller. Granite country is then passed over for the next 20 miles, till the field is reached.

There are two main lines of reef—the Alice Queen line and the Peninsular King line—situated about half a mile apart in a north and south direction, and with practically the same strike in that direction, so that the two reefs would appear to be on the same line.

The Alice Queen Reef.

On the Alice Queen reef a shaft has been sunk to a depth of 112 ft., on a reef some 6 ft. in thickness, from which, up to the present time, some 661 tons of stone have been crushed, for a return of about £3 18s. per ton. Down to about the 76-ft. level the crushings average about £4 11s. per ton.

A drive at the 100-ft. level was carried in to the south about 24 ft., where the reef pinches to about 1 ft. in thickness. The drive to the north was stopped about 6 ft. from the shaft, owing to trouble with the ground on the hanging-wall. It showed about 6 ft. of reef in the face. The stopes above this level to the south and the shaft, from 76 ft. down, have given about 300 tons of stone, worth about £3 11s. per ton. About 20 ft. north of this shaft another, called the No. 1 North, was put down, but there is no record of the amount or value of the stone taken from it, nor was I able to inspect it.

The lower value of the stone below the 75-ft. level is perhaps accounted for by the fact that it was mineralised stone, from which the gold extraction could not have been complete with the battery in use.

Considering the width of this reef and the value of the stone, it should be worth more vigorous prospecting, by driving along the reef, than it is getting at present. The shoot of good stone worked down to the 100-ft. level is comparatively short, as evidenced by the small amount of stone raised up to the present, but it is at least possible that other good shoots may be developed by further prospecting.

The Peninsular King Reefs.

On the Peninsular King line of reef several shallow shafts have been sunk, but only one—that on Dickie's Reward Claim—was working at the time of my visit. This shaft was 45 ft. on the reef, and almost vertical. At 35 ft. the reef had been driven on about 10 ft. to the north, but, the ground having fallen in, the reef could not be inspected. The level was also driven on the reef for about 25 ft. to the south of the shaft, and showed about 2 ft. of reef in the face. About 59 tons of stone from this shaft has returned 158 oz. gold, worth about £505, so that the average value of the stone hitherto raised has been about £8 10s. per ton.

This reef appears to be worth systematic prospecting. A few yards east is a reef about 30 ft. across, from which a small crushing was taken, but as the stone was mixed with that from another shaft, the value was not determined.

About 200 ft. south of the Reward Claim and across the creek, apparently on the same line, a big white reef of quartz was sunk on in *No. 5 South Peninsular King Claim* to a depth of 42 ft., and the reef was stoped out to the surface for 6 ft. north and 10 ft. south of the shaft, those limits bounding the good stone. From this work 197 tons of stone were crushed, and returned 309 oz. of gold, giving an average value for the stone of about £5 per ton. Stone of a value of ½ oz. to the ton is said to be still in the bottom and in the face. Judging from the amount of stone that has been crushed, the reef must be nearly 3 ft. in thickness, and notwithstanding the shortness of the shoot of good stone, the reef there should be well worth further development. Between Dickie's present shaft on the P.C. claim, above described, and the No. 5 South claim, the reef has been proved by a shaft sunk in the bed of the creek, which gave 37 oz. of gold from 32 tons, so that the permanency of the reef between the P.C. shaft and the No. 5 South shaft is pretty well established.

About 100 ft. south of the No. 5 the same reef, here about 2 ft. wide, was sunk on to a depth of about 15 ft., and gave 10 oz. of gold from 14 tons of stone, which, with carting at 8s. per ton, and crushing at 25s. per ton, proved too poor to pay.

About 100 yards west of Dickie's present shaft another reef was sunk on in No. 1 shaft, and about 10 tons gave ½ oz. to the ton, which proved too poor to be payable.

The average value of all the stone crushed up to the present from the Peninsular King claims has been over £5 per ton. The reefs crop out strongly on the surface, and show every sign of permanency with depth. The best stone apparently does not run uniformly through the reefs, but their indications of permanency and large size should make them worth systematic development, with a view to ascertaining what quantities of crushing stuff would be available for a well-designed and economical system of mining and treatment.

III.—THE HAMILTON GOLDFIELD.

1. YARRADEN.

The Golden King Line.

This is a line of reef running about north-north-west through granite country, and standing practically vertical.

On the P.C. Claim, now embraced in Gold Mining Lease No. 10, a shaft has been sunk to a depth of 212 ft. At 106 ft. a level goes north for 80 ft., where a fault was met with, throwing the reef a few feet to the eastward. This fault was met with at about the same distance from the shaft in the level above at a depth of 45 ft. The ground on this side of the shaft has been all stoped out from the

45 ft. upwards. Below that is a solid block of ground, not yet touched, to within 16 ft. of the bottom level, to which point it has again been stoped out from that level. In stoping from the latter level the reef was found to pinch at this height, and was left for a more opportune occasion before being broken down.

The 106-ft. level south has been driven 75 ft. to the boundary of the claim with No. 2 South, and the reef above all stoped out, except about 100 tons of stone still left on the boundary between the two levels.

Below the 106-ft. level the shaft has been sunk, with a slight underlie to the west, to a depth of 212 ft. From the last 94 ft. of sinking 130 tons of stone were obtained, and gave a return, on crushing, of 228 oz. 4 dwt. of gold. As the shaft was about 12 ft. across, this shows an average of about 20 in. of reef. As the gold here is worth about £2 12s. per oz., this stone was worth about £4 11s. per ton.

No. 1 South claim workings adjoin the P.C., the two being now embraced in Gold Mining Lease No. 10. The reef has all been stoped out on this ground to a depth of about 80 ft., over a length of 200 ft., from two shafts sunk towards the middle of the ground.

From the P.C. claim, according to the returns given in the Warden's annual reports, 756 tons have been crushed from above the 106-ft. level, for a return of 1,361 oz. 9 dwt. 0 gr. of gold, of a value of £3,539 14s. This gives about £4 13s. per ton, so that the crushing from the sink has been well up to the average.

From the No. 1 South ground 578 tons have been crushed from above the 80-ft. level, for 1,026 oz., of a value of £2,667 12s. This gives an average value of the stone from this ground of about £4 12s. per ton.

There has, therefore, been proved here, to a depth of nearly 100 ft., a continuous shoot of stone, of an average width of about 16 in. over a length of about 350 ft., worth over £4 10s. per ton, and which has returned over £6,000 for the first 100 ft. of sinking. The reef occurs between well-defined walls, and apparently occupies a true fissure in the granite, showing every indication of permanency with depth.

South of the boundary of No. 1 South ground there appears to be a break in the reef, or a barren portion, as a shaft sunk on the No. 2 South ground near the northern boundary found no stone.

On No. 3, No. 4, No. 5, and No. 6 South claims an almost continuous reef on the same line has been worked by a number of shallow shafts over a length of nearly 600 ft., to a depth of from 40 to 80 ft. From these shafts, up to the present, some 1,305 tons of stone have been crushed, for a return of 2,339 oz. of gold, worth £6,081. The reef here appears to be more patchy in gold contents, some of the faces

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The Lukin King Reefs.

The reefs here occur in graphitic quartz schists
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done on the No. 1 South claim. Here a shoot of st
in length has been followed down for about 50 ft. by
(called No. 2 Shaft), dipping steeply to the west. T
body of stone, which was about 5 ft. thick at the shaft,

showing white, poor-looking quartz, which has been left as too low-grade to pay for mining and crushing under present conditions. The value of the stone crushed, however, has averaged £4 13s. per ton, which still leaves a considerable margin for profit if the stone were taken out by economical methods and crushed in bulk. The reef varies from about 6 in. to 15 in. in thickness, and occurs between well-defined walls, showing every indication of a permanent fissure. It will thus be seen that this reef has already furnished £12,000 worth of gold from within 100 ft. of the outcrop. It shows every indication of being able to turn out large quantities of payable crushing stuff at greater depths, if economically developed.

The Savannah Reef.

This line of reef lies about a quarter of a mile east of the Golden King line. The main shaft is 124 ft. in depth, following the reef on a steep underlie to west. At the bottom level the shoot of stone is about 100 ft. in length, lying to the south of the shaft, the reef in the level, a few feet in to the north of the shaft, breaking up into small veins of streaky quartz. In the stopes above the 124-ft. level the reef shows from 1 ft. 6 in. to 2 ft. in thickness.

The ground above the 80-ft. level has all been stoped out for about 100 ft. south of the main shaft. Beyond this the reef has only been worked to the 40-ft. level for about 50 ft., the reef here splitting up into ill-defined leaders of quartz.

The work on this reef down to the 124-ft. level has given 1,359 tons of stone, which have returned 3,616 oz. 8 dwt. of gold, of a value of £9,040. At the time of my visit preparations were being made to sink the shaft a further 100 ft. The first 25 ft. of this sinking was reported to have given 40 tons of crushing stuff, which would indicate fully 2 ft. of reef at this point. Judging from the value of the stone (which has, so far, averaged about £6 13s. per ton), the size of the reef, and length of shoot, the prospects of this mine look hopeful.

The Lukin King Reefs.

The reefs here occur in graphitic quartz schists and talc schists, which have a general meridional strike and steep dips. The reefs occur as lenticular bodies of quartz following the bedding planes of the schists, and are remarkable for the rapidity with which they bulge to large sizes or cut out to nothing. They all lie more or less on the one north-and-south line, but, owing to the twisting of the schists and the absence of quartz in many places along the line, can hardly be affirmed to be the one reef. The greatest amount of work has been done on the No. 1 South claim. Here a shoot of stone about 40 ft. in length has been followed down for about 50 ft. by an inclined shaft (called No. 2 Shaft), dipping steeply to the west. To the north this body of stone, which was about 5 ft. thick at the shaft, pinched rapidly out, and, though the drive was extended for another 100 ft., no further stone was met with. About 40 ft. south of the shaft the stone cut out against a cross reef, which was worked from No. 1 Shaft, but did not furnish a large quantity of stone. From the main shoot of stone some 1,066 tons of stone were raised, and yielded 1,607 oz. of gold, worth about £5,222, giving an average value of about £5 per ton for the stone.

A crosscut east from the bottom of the shaft met a parallel body of quartz of about the same length and thickness, which is now being mined ready for crushing.

About 108 ft. north of the No. 1 Shaft, and just beyond the end of the drive above referred to, was a body of stone worked down to the 50-ft. level in the P.C. claim. Two other bodies of good stone have been worked, within the next 400 ft., along the line to the north, the total product from the three shafts having been some 270 tons of stone, returning about 300 oz. of gold.

The Gold Mount Reef.

This reef occurs as a lenticular body of quartzite, about 25 ft. across at its widest point. It has been worked for a length of about 500 ft. by means of several shafts, situated mostly on the hanging-wall, where about 7 in.* of quartz of good quality is found. On the footwall another 15 in. has been worked to a slight extent. The reef strikes north and south through schists and slates, of which the quartzite of the reef is apparently merely a lenticular member, consisting of coarser material. The two richer portions on the hanging-wall and footwall may have been the result of subsequent introduction of silica.

About 274 tons of stone have been crushed from along this line, for a return of 705 oz. 4 dwt., giving an average value of about £8 per ton for the stone. As mentioned above, this has come mainly from the hanging-wall vein. A shaft near the northern end of the original P.C. claim has been sunk to a depth of 90 ft. on this vein. A crosscut is said to have been put in across the reef to the footwall vein, and a bulk crushing of the whole 25 ft., consisting of about 20 tons, is reported to have given 14 dwt. of gold to the ton. There is no record, however, of such a crushing in the Warden's books, the last crushing (March, 1906) showing 40 tons for a little over 11 dwt. per ton.

The appearance of this reef and its records should warrant the expenditure of a moderate amount of capital in properly testing its value. The mine lies about two miles north-east of the Lukin King Mine, over a somewhat rough track.

2. EBAGOOLAH.

In the neighbourhood of the township of Ebagoolah reef mining was practically at a standstill, the only underground work going on being on the Hamilton King Reef, where a tribute party of three were raising stone from a leader in the shallower levels. The majority of the workings could not be inspected, and the only information that could be obtained was second hand, or from the Warden's reports and records of outputs.

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* Inadvertently printed 7 feet in "Mining Journal," December, 1906.

The reefs here occur as bedded veins in quartz schists. The shoots of ore are mostly short, and the thickness and gold contents of the veins very variable. The better shoots of ore so far discovered have all been worked out, wherever payable, as far as the water-level, and only in one case has any successful attempt been made to mine ore below the water, the want of capital having prevented the introduction of pumping and winding machinery capable of mining at any depth. On the Caledonia Reef a small winding plant and pump have allowed of the shaft being taken down a depth of 206 ft., but in no other case have greater depths than 130 ft. been reached. Pumps were also installed at the Tasmania and Hidden Treasure Mines, but, either through excess of water or want of knowledge of the machinery, no permanent progress was made.

The following table shows the amounts of stone crushed and gold obtained from the most important reefs in the neighbourhood of Ebagoolah, as recorded in the Warden's annual reports up to the end of 1906:—

	Stone Crushed.		Gold Returns.	
	Tons.		Oz.	dwt.
Caledonia	2,574	...	2,641	19
May Queen	1,996	...	2,574	5
Hamilton King	1,535½	...	2,258	9
Hit-or-Miss	1,072	...	2,157	3
Hidden Treasure	1,500	...	1,511	3
All Nations	494	...	1,221	8
Golden Treasure	859	...	1,118	16
Violet	560½	...	1,464	16
Trafalgar	420	...	892	6
	11,011		15,840	5

TABLE SHOWING RESULTS FROM MAIN LINES OF REEFS NEAR EBAGOOLAH.

This shows a return from nine lines of reef of 11,011 tons of stone, of a value of over £47,000,† giving an average value for the stone of about £4 6s. per ton.

The Caledonia Reef.

This reef stands with a slight underlie to the west, and has been mined by a shaft following the underlie to a depth of 206 ft. from the surface.

At 60 ft. from the surface a level has been driven south for 100 ft., and the ore stoped out to the surface. North, this level is said to have been driven about 90 ft., and the ground stoped to the surface. At 90 ft. a second level was driven north a distance of 50 ft., where the reef was faulted, the drive coming up against a clearly-defined wall striking diagonally across the drive and making an obtuse angle on the hanging-wall side. The ground above this level has been stoped out up to the 60-ft. level. At the 152-ft. level north the same fault is met with at 87 ft. from the shaft, and a great portion of the stone above it to the 90-ft. level has been stoped out.

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† Inadvertently given as £15,840 in "Mining Journal," December, 1906.

To the east of the shaft, at the 152-ft. level, a short drive shows a large body of white stone, about 18 in. of which is said to be worth crushing. In the sink below the 150-ft. level a large body of stone was sunk on, but carried very little gold, the shoot of gold-bearing stone evidently crossing the shaft above that level from south to north.

This reef has given about 2,574 tons of stone above the 150-ft. level, which has yielded 2,641 oz. of gold, worth £7,586, showing an average value for the stone of nearly £3 a ton. This indicates an average thickness of about 2 ft. of crushing stuff over a length of about 100 ft. of a shoot of stone as far as the workings have gone at present. The great irregularity in the richness of the reef, however, and faulting of the ground to the north have increased the troubles of working to such an extent that it is difficult to form any opinion as to the prospects of success with further sinking. The prospects of finding the reef north of the fault are, however, worth the expenditure of a little money. This continuation does not appear to have been traced on the surface, and might possibly be revealed by trenching across the line in that direction.

The May Queen Reef.

On the *May Queen* an underlie shaft has been sunk on the reef dipping at an angle of about 60° to the east to a depth of about 95 ft. and the reef driven on at that depth 45 ft. north and 35 ft. south, and the stone stoped out from the surface to this depth. The ground below the level was also stoped out for another 5 ft. down by underhand work. This work gave 1,996 tons of crushing stuff, from which it may be judged that the reef averaged about 4 ft. thick over a length of shoot of about 90 ft. The average value of the gold is returned as about £2 9s. per oz., giving an average value for the stone of about £3 3s. per ton, and a total value for the 100 ft. from the surface of £6,306.

The shaft was continued below the 95-ft. level a distance of another 45 ft., but the reef was lost in the first 5 ft. This portion of the shaft was inaccessible, so that it is impossible to say what has caused the loss of the reef in the lower levels. It seems probable, however, that it would be picked up again by crosscutting at the bottom. As yet the water-level has not been reached. The shaft is in good order to the 95-ft. level, being about 11 ft. by 4 ft. and well timbered. The reef occurs in mica schists, and apparently runs alo the bedding planes of the country rock. At the southern end of t 95-ft. level about 1 ft. 6 in. of white quartz is showing, which shou be worth driving on.

The Hamilton King Reef.

On the Hamilton King reef a shaft has been sunk to a verti depth of 60 ft., where the footwall of the reef was struck. Lev were driven north about 60 ft. and south about 50 ft., and the r stoped out up to the surface. The ore on the northern side was a stoped out underhand below the level for a depth of from 15 ft. 20 ft. The shaft was then sunk a further 70 ft. below the No. 1 le and a level driven at 56 ft. for about 20 ft. to the south, but the st was not payable, and the mine was abandoned. From the stopes do to the 60-ft. level and the underhand stoping to the north below t level 1,535 tons of stone were obtained for a return of 2,258 oz. 9 d worth £6,775 7s., showing an average value for the stone of ab £4 8s. per ton.

The Hidden Treasure Reef.

This reef occurs in gneisses and schists, and apparently follow bedding plane of the country. It has been worked to the water-le (about 40 ft.) over a length of about 300 ft. by a number of shall shafts. In only two shafts was there any attempt made to mine bel the water-level. Of these, the northern one was sunk to a depth 90 ft., and levels were put in at a depth of 60 ft. to distances of 45 north and 25 ft. south, and the ground stoped up to the old surf workings, here about 35 ft. in depth. From this work 158 tons stone is reported to have been crushed for 159 oz. of gold, which poi to an average of about 12 in. of reef, worth an ounce to the t About 180 ft. further south the second shaft was sunk to about 90 by means of a pump supplied by the Government; but below water-level the reef is reported to have been too poor to be remune tive, and no stoping was done. The total returns show an aver value for the stone of about £3 per ton, and, judging from the amo of material crushed, the reef must have averaged well over 12 in. thickness.

The Hit-or-Miss Reef.

On the *Hit-or-Miss Reef* a shaft has been sunk to a depth 130 ft. on the underlie, dipping steeply to the west. At about 50 a level was driven south for 30 ft., and the stone stoped up to t surface. Beyond this distance the reef pinched, but was followed for another 10 ft. To the north a level at 30 ft. was driven for ab 100 ft., and the ground stoped out to the surface. Good ore was fou underfoot, about 40 ft. in. This was followed down to the 94-

level, opening out as it went down towards the north till, at the lower level, the shoot was about 30 ft. in length, and showed about 9 in. of quartz in the face 70 ft. from the shaft.

The level south at 94 ft. was driven on stone for about 50 ft., and stoped up to the 50-ft. level, the face of the stopes going back as they went up till they met the end of the upper level. This part of the mine was inaccessible. An attempt was made to underhand stope below the 94-ft. level to the south; but after taking out about 6 ft. the water proved too much for the pump, and the work was abandoned. From a second shaft, sunk 42 ft. further south to a depth of about 30 ft., a few tons of ore were also obtained.

The returns show about 1,072 tons of stone from these workings, worth about £6,471, and thus averaging about £6 per ton. The trouble with water seems to have been the cause of abandonment of such a promising mine.

The Violet Reef.

This reef lies about seven miles due south of Ebagoolah, on the road to Yarraden. The reef strikes north and south through granite country, and underlies at about 70° to the west. The stone runs generally from about 1 ft. to 2 ft. in thickness between well-defined walls of granite. On the P.C. claim, the main shaft is 80 ft. in depth, and was worked by means of a whip. At that depth a level was driven south for 30 ft., and the stone stoped out to a height of 30 ft., being still solid above. To the north a level was taken in at the 40-ft. level, the reef being still untouched below, and the stone all stoped out between here and the next shaft to the north, called Marr's Shaft, a distance of 105 ft. off.

Between here and the next shaft, called the Tributer's Shaft, 75 ft. further north, the reef has been driven on at the 35-ft. level, but no stoping done, except near the latter shaft. The roof of the level was falling in, and could not be inspected. About 18 ft. of the reef south from the Tributer's Shaft has been stoped out from the 35-ft. level up, and shows 20 in. of solid stone between well-defined walls at the end of the stope. To the north a level at the 35 ft. goes about 27 ft., and the reef has been stoped out from here up to the surface. The level has been extended another 18 ft. north, and shows about 20 in. of solid reef between well-defined walls.

It will thus be seen that this reef has been worked from three shafts over a length of about 250 ft. From these shafts 560 tons are recorded as having been crushed, for a return of 1,464 oz. 15 dwt. of gold. This represents an average of 2 oz. 12 dwt. per ton; but, although not recorded, I understand that the value of this gold was only about £2 per oz.; so that the value of the stone was not more than about £5 4s. per ton. From the amount of work done, and the stone crushed, I should judge that the reef, where worked, ha averaged about 18 in. in thickness. Considering the length alon which gold has been found on this reef, and the evidences of perma ency, it appears to be well worth more systematic development belo the water-level (about 35 ft.) than can be effected by bailing with whip horse.

3. Potallah Creek.

The Perseverance Reef.

This is the only reef that has been worked in this neighbourhoo It strikes about north and south, and dips steeply to the west, lyi in slate country, with about the same strike. It has been work down to a depth of about 40 ft. over a length of about 80 ft., and tl working furnished 584 tons of stone, which returned some 587 of gold. There is no record of the value of the gold, but, taking at £3 per oz., this would give a value to the stone of about £3 per t Judging from the amount of stone crushed, the reef has averag about 2 ft. 6 in. over the 80 ft. of working.

The reef was found in 1902, and a small battery was erected 1904. The battery was removed at the end of the year, and the m has been idle since.

The mine lies on a tributary of Crosbie Creek, about 25 mi west-north-west of the Alice Goldfield, and 50 miles south-south-w of Yarraden. Its isolated position accounts perhaps more than a thing for its having been abandoned after having furnished £1,7 worth of gold above a depth of 40 ft. It can be reached by a g dray road either from the Alice or Yarraden.

IV.—THE COEN GOLDFIELD.

The Great Northern Mine.

The only mine working here at the time of my visit was t Great Northern. The main shaft is on the original P.C. groun which has now been amalgamated with the No. 1 South ground to t south and the Abdulla and Victoria ground to the north. Down the 190-ft. level the ground has been nearly all stoped out for distance of 280 ft. to the south and 270 ft. to the north. At a dep of 275 ft. levels were again opened out and driven on stone distances of 280 ft. north and 300 ft. south, and the reef all stop out to the No. 2 level. To the north the stope is thus 10 ft. beyo where the reef was left in the No. 2 level, being at that time unpa able. The No. 2 level has now been proved here, and the stope being carried on up above it.

From this block of stone above the 275-ft. level, and over length of nearly 600 ft., some 17,407 tons of stone have been crushe worth about £86,234. This gives an average width of about 18 in. of crushing stuff down to the 275-ft. level, worth on an average nearly £5 per ton. Before 1899 this line of reef was worked as four claims—the Abdulla and Victoria to the north, and the No. 1 South to the south; and the average of all the stone got from above the 190-ft. level was about £3 18s. per ton. These claims were amalgamated in the latter end of that year, and since then 9,948 tons of stone have been obtained—a great part from between the 190 and 275 ft. levels—the average value of the stone since that time having been over £5 14s. per ton. This increase in value has apparently been caused by the discovery of several rich patches of stone between the 190-ft. and 175-ft. levels, which have very much increased the average return of the material crushed.

The shaft has recently been sunk to a depth of 375 ft., and levels had been driven north 181 ft. and south 140 ft. at the time of my visit. The reef in the shaft at this level and in the levels themselves shows about 3 to 4 ft. of quartz, but is too poor to pay for crushing, and it has all gone over the tip. On the north side, however, a winze was sunk from the 275-ft. level, at a distance of about 120 ft. from the shaft, on fair stone, to about 60 ft., and a level was being driven north and south at this depth.

Since my visit also I understand that good stone has been struck in the continuation of the drive at the bottom level to the north. Otherwise, however, the developments below the 275-ft. level in this mine have not been as remunerative as in the higher levels.

WALTER E. CAMERON.

Brisbane, 1st December, 1906.

By Authority: George Arthur Vaughan, Government Printer, William street, Brisbane.

Queensland.

DEPARTMENT OF MINES.

Geological Survey of Queensland.
PUBLICATION No. 210.

THE ANNAN RIVER TINFIELD,
COOKTOWN DISTRICT.

WITH ONE MAP AND FOURTEEN PLATES.

BY

WALTER E. CAMERON, B.A. (Canad.),
ASSISTANT GOVERNMENT GEOLOGIST.

BRISBANE:
BY AUTHORITY: GEORGE ARTHUR VAUGHAN, GOVERNMENT PRINTER, WILLIAM STREET.

1907.

Plate I.

HOME RULE FALLS, UPPER ANNAN RIVER, COOKTOWN DISTRICT.

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THE ANNAN RIVER TINFIELD,

COOKTOWN DISTRICT.

I. LOCATION, ACCESSIBILITY, AND GENERAL FEATURES.

The Annan River Tinfield covers an area of about 100 square miles of mountainous country bordering the sea coast between the mouths of the Annan and Bloomfield Rivers, south of Cooktown. This mountainous country is bounded on the west by the valley of the Annan River. The river for the first 25 miles of its course flows in a northerly direction parallel with the coast, and at a distance of from eight to ten miles from it. About four miles south of Cooktown the river takes an easterly bend, and, flowing through more level country, enters the sea in Walker's Bay, just south of Mount Cook. The mountainous country of the tinfield forms the upper sources of the river, the drainage being mainly towards the west into the river, leaving only short and rapid watercourses on the fall to the coast. The mountains culminate in Mount Finlayson, near the sources of the river, at a height of over 3,500 ft. above the sea, while Mount Hartley, at the source of Wallaby Creek, and Mount Amos, at the source of Trevethan Creek, are both well over 2,500 ft. The tin claims, with the exception of a few on the eastern slopes of Mount Amos, are all situated on the various branches of the westerly-flowing tributaries of the Annan, which have cut their way back into the hills to within a mile or two of the coast, and thus afford easy means of access from the main Cooktown to Bloomfield road, running up the Annan River and giving communication with the port of Cooktown.

The main road from Cooktown crosses the Annan River about five miles out by a fine low-level bridge, and can be used for wheeled traffic as far as Mount Leswell, 25 miles to the south, after which it is merely a pack track, though drays have been taken out as far as Romeo, six miles further south, near the sources of the river.

About 12 miles out from Cooktown the first branch road turns off to the left, leading to Mount Amos. Running up Trevethan Creek, it reaches the claims at the head of that creek and on the eastern slopes of Mount Amos in another ten miles. About 17 miles south of Cooktown a second branch road to the left turns off up Mungumby Creek to the Tableland claims at the head waters of that creek, about 1,200 ft. above the river valley. Just beyond the junction of Wallaby Creek with the Annan, five miles past Helenvale public-house, and 26 miles from Cooktown, a third branch road turns off to the left, running up Wallaby Creek, and reaching, in another five miles, the

The granite area is shown on the Geological Map of Queensland as stretching across the Bloomfield River for another 20 miles south of the area under consideration. It extends here to a width of 20 miles across, forming the rough jungle country at the head of the Bloomfield River (known here as the "Roaring Mag"), and rising, in Mount Peter Botte, to a height of 3,300 ft. The alluvial tin claims of the Bloomfield Scrub and China Camp lie in this little-visited area, which is very rugged in character and covered with thick scrub, rendering it exceedingly difficult to properly prospect. Very possibly other areas yet await development in this direction. My time did not allow of a visit to this locality.

Tin lodes have been worked on the slopes of Mount Amos, at the Lion's Den on the Tableland, at the Collingwood, and at Mount Leswell, but so far without any marked success, and little work has been done on them for a number of years. Recently prospecting work has been resumed on the old Mount Browning lodes at Mount Amos, and I understand that the Collingwood Company propose shortly to open out again on the lodes of the old Collingwood and Mount Leswell Mines.

The lodes about Mount Amos lie along parallel joint planes of the granite, and are due to alteration of the granite walls of the joints by mineralising vapours or solutions that have been forced into them from below. They are characterised by intense tourmalinisation and silicification of the granite along the joint planes, the zone of alteration in some cases occupying a width of as much as 10 ft., and being traceable at detached points along the joints for considerable distances. The persistency of the joints and the possibility of picking up tin-bearing material at numerous points along a considerable length in one straight line has led to the idea in some cases that these tin-bearing joints are continuous lodes of ore. This inference, however, cannot be relied on, as the width of the zone of alteration to lode matter and its richness in tin contents vary rapidly from place to place, and, as far as can be seen at present, the shoots of ore are not very long.

The number of these joints, with their veins of tin-bearing tourmaline and quartz running up the sides of Mount Amos, must be very numerous, as the gravels down its sides and in the flatter ground along Waterfall (or the Main) Creek, which have been worked for many years for alluvial tin, are composed very largely of pebbles and boulders of quartz and tourmaline, which have evidently been derived from these veins.

In the old alluvial workings on the slopes of Mount Leswell the same prevalence of tourmaline boulders is noticeable, as well as in the heaps of mullock around the old shafts; but no examination can now be made of the old workings.

At the Lion's Den (Tableland) a similar character of minerali tion along the numerous parallel joints of the granite can be notic It seems likely that the greater part of the tin of the gullies and cre flats has been derived from the degradation of inummerable sm veins along the joints of the granite, of which those worked at Mou Lesswell, the Lion's Den, and Mount Amos, on account of their great size and exposed position, have attracted attention, while others of le prominence have, on account of the thick growth of scrub and t depth of surface soil, escaped notice.

III. THE ALLUVIAL DEPOSITS.

As mentioned incidentally before, the country of the tinfield co sists of an area of rugged mountains diversified by deep valle running back into and surrounded by them, this carving out of t granite having been more pronounced in the valleys draining to t west into the Annan River. In the upper portions of their cours these streams are characterised by comparatively moderate slopes, wit sufficient meandering of their courses to allow of the formation numerous beaches of tin-bearing gravel and their preservation by t accumulation over them of considerable depths of alluvial. Of the higher beaches, situated at heights of from 1,000 to 2,000 ft. abo the sea, may be mentioned the gravels worked along the upp branches of Mungumby Creek, on the Tableland country, those on t upper branches of Slatey Creek, Mount Hartley Creek, Jones Cree and other tributaries flowing into Wallaby Creek, the workings Finnigan's on the western fall of Mount Romeo, and the workin along Grass-tree and Jackaroo Creeks, and the tributaries of t Romeo branch of the river. These higher alluvial deposits are ha up by bars of harder rock, which have arrested the erosive power the streams along their beds, and thus allowed of the corrasion of t banks above them with an accompanying deposition of tin-beari gravel and sand in the bends. Over these bars of harder rock t creeks plunge, to levels little above those of the river, in a successi of cascades and falls, often of exceeding beauty. Amongst the mo beautiful of these may be mentioned the Home Rule Falls, on Slat Creek, of which a fine view is reproduced on Plate I. Hardly less beau ful are those on Mungumby Creek, Mount Hartley Creek, Parr Creek, and the Romeo branch of the Annan River. It is these grave bordering the upper reaches of the streams flowing into the Anna which have given the great bulk of the tin from the Annan field some of the terraces—such as those at the Tableland, Finnigan Jackaroo Creek, and Romeo—having been worked continuously sin the opening of the field in 1886. Plate II. is a view of the face of o of these high-level gravels in Wilson and Muir's claim, on Kimberl Creek, at Romeo, which has been worked up from the junction wi Romeo Creek for 300 yards.

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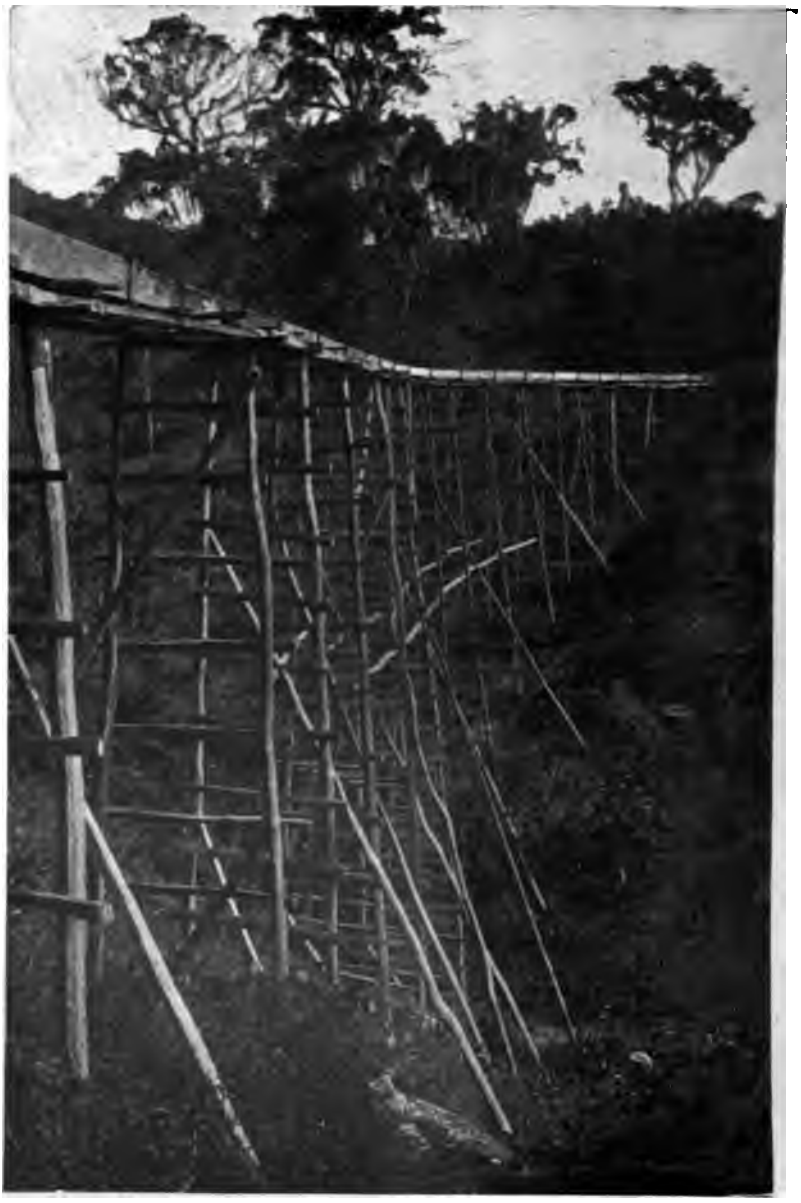
1907.

Plate III



WILSON AND MUIR'S FLUMING OVER BAIRD'S CREEK, ROMEO.

FIFTY FEET ABOVE CREEK LEVEL.

Below the bars of harder rock which hold these gravels up, and which give rise to the numerous cascades and falls along the main creeks, the streams flow in deep rocky valleys hemmed in on either side by steep hills and mountains, which still give evidence of the former heights at which the streams must have flowed. The streams have, however, here and there along their lower curves—where softer country has given opportunity for lateral corrasion of their banks—been able to pile up accumulations of alluvial, to which attention has of late years been devoted as a source of tin. The more gradual fall of these lower portions of the streams, due no doubt to the fact that they have been carved out by the gradual recession of the falls, and the thickness of stripping of sand often found above the tin-bearing wash, has been a hindrance to economical sluicing by ordinary methods. Since the increase in the price of tin attention has been given to some more economical method of working them, either by hydraulicing the face with water under pressure or by dredging with buckets or suction and thus reducing the cost of moving the over-burden. At present some 2,000 acres of alluvial ground along the river and its numerous tributaries have been taken up for this purpose.

IV. METHODS OF WORKING ALLUVIAL.

Sluicing.

The total recorded yield of tinstone (cassiterite) from the Cook district from 1886 to 1905 has been 7,409 tons, valued at £413,040. The great bulk of this output has come from the Annan River field, and the larger portion has been stream tin won from the upper sources of the streams. The yield was greatest during the first three years, amounting to 1,051 tons for 1888, after which it gradually decreased till, in 1897, it had come down to 146 tons. Since then the return has remained fairly constant, the average for the last nine years having been about 150 tons. The output for 1905 was 142 tons, valued at £12,462.

During the first few years after the first rush in 1886 the tin was won mainly from the beds of the creeks and their immediate banks by sluicing the gravel in boxes with the water coming down the creeks. Any overlying alluvial soil was stripped by hand, and the gravel lifted and wheeled in barrows to the boxes. As the bottom rose above the level at which the water of the creek could be conveniently brought within easy distance of the face, the wheeling became too expensive, and the face was left for other more easily worked places. As these deeper portions along the present beds of the creeks became exhausted, attention was turned to the higher terraces which lay further back, and which could only be worked economically by bringing in water from some higher source, and using it to wash off the alluvial overlying the tin-bearing wash along the bottom by carrying it over the face of the banks. To do this, races had to be constructed, often of several miles in length, and sometimes necessitating considerable ingenuity in the erection of fluming or piping to carry the water over intervening gullies.

Plate III. gives a picture of a piece of fluming which has been used for the last 16 years to carry water across Baird's Creek at Romeo to Wilson and Muir's claim on Kimberley Creek. The height of the fluming above the bed of the creek is 50 ft., and the length about 150 ft. The uprights are all of round timber, obtained in the neighbouring scrubs, and many of them had to be brought from considerable distances. The size of the boxes is 12 in. bottoms with 10-in. sides, having a grade of 1 in. in 10 ft.

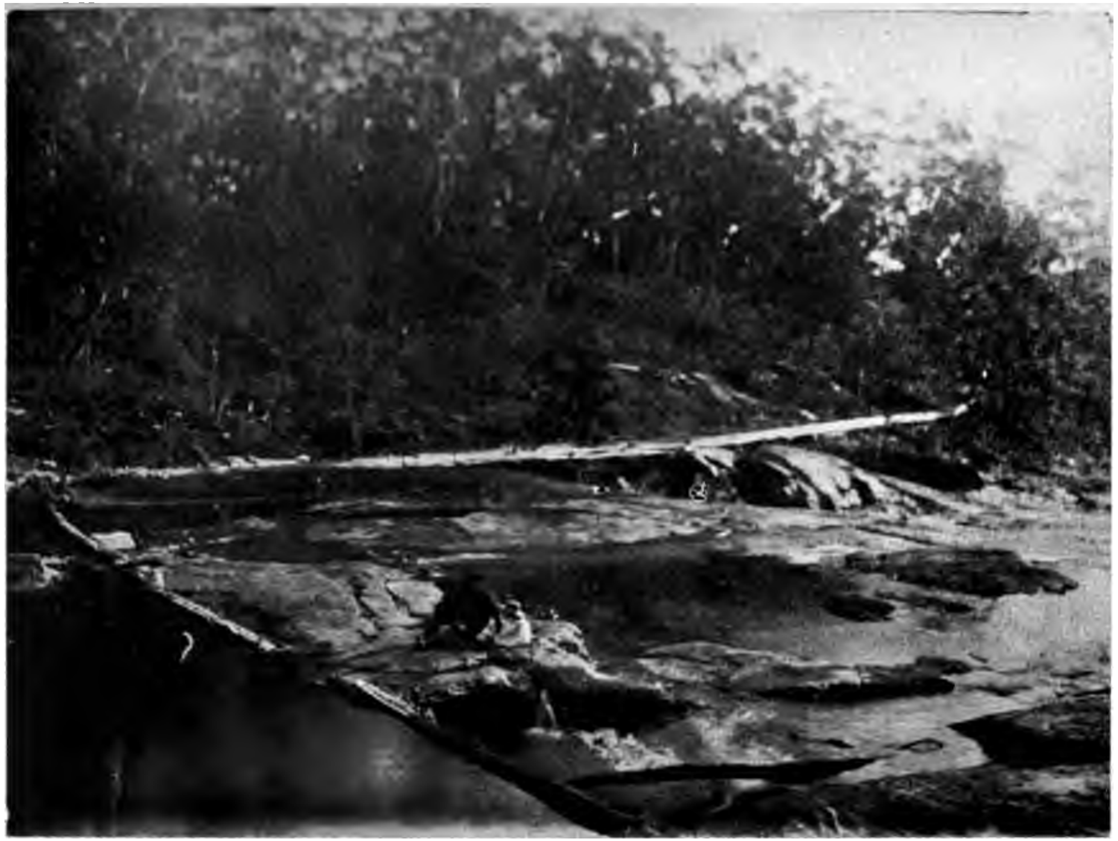
Plate IV. is a picture of a dam on the upper waters of the Annan River supplying water to Bolen and Bathe's claim at Grass-tree, and shows the method adopted for turning the water off into fluming, running along the rocky banks of the creeks and communicating with a race as softer ground is reached.

Recently attention has been turned to several residual deposits lying on the flatter slopes of the hill sides, well away from any water-courses. Here the advantages of an easy getaway for the tailings and the shallowness of the stripping above the wash compensates to a considerable extent for the comparative poverty of the ground. Among these residual deposits that have been worked lately may be mentioned the ground first opened up by Bolen and Bathe above the old workings at Finnigan's, a portion of the ground now being worked by the same men at Grass-tree, and the ground on which hydraulic sluicing has lately been started by Yates at Romeo. The ground recently opened up for hydraulic sluicing by the Annan River Company on the slopes below the Mount Leswell lodes is of the same character.

HYDRAULICING.

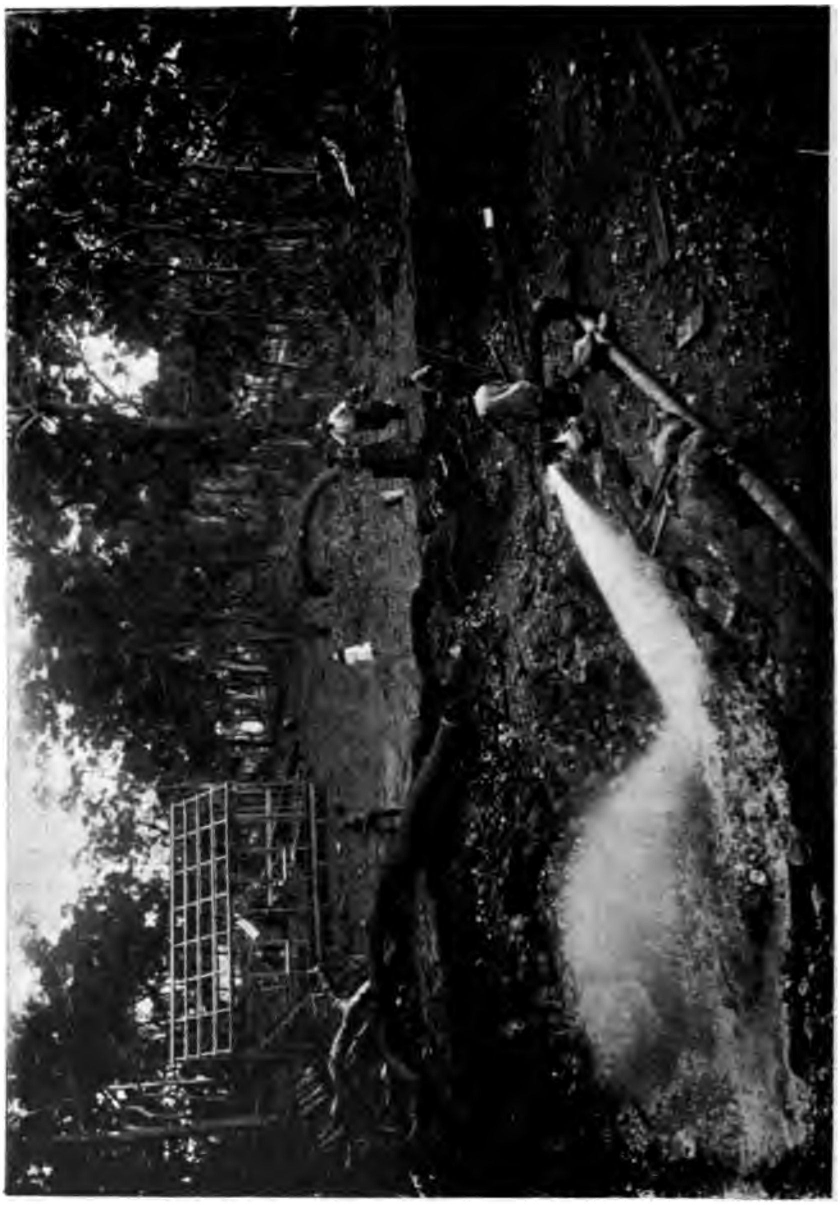
This class of ground, on account of the fact that the slope is generally steep, and that the areas of ground are fairly extensive, has possibilities for hydraulic sluicing which have been availed of in the last two cases, and also formerly on Bolen and Bathe's ground at Finnigan's. In the latter case the numerous stones and boulders in the ground gave considerable trouble, and led to the abandonment of this method of working, while at the Annan River Company's workings the same difficulty has been felt. On the Annan River Company's ground the cemented character of much of the ground has also been the cause of much delay, necessitating the breaking up of the ground by blasting before it would yield to the force of water. In this case the company are operating with a pressure of 240 ft. through a 2-in. nozzle. The nozzles, however, supplied up to the present have been faulty in design, causing a spraying of the jet of water, which renders it very deficient in cutting power.

Plate IV.



BOLEN AND BATHE'S DAM AND FLUMING, GRASS-TREE, UPPER ANNAN RIVER.

Plate V.



HYDRAULICING RESIDUAL DEPOSITS, ANNAN RIVER COY.'S GROUND, BELOW LESWELL MINES.

Plate V. gives a view of the ground being worked by the Annan River Company, and shows the spraying of the jet from the moment that it leaves the nozzle. At Yates's claim at Romeo the pressure used is about 100 ft., through a ⅞-in. nozzle, but the soil here is loose and friable and almost free of boulders. I was informed that the ground can be broken by the nozzle at a much greater rate than it can be carried through the tail race by the volume of water available from the nozzle, and this method of working has proved well adapted to this ground, entailing a great saving of labour over the ordinary methods of sluicing. Plate VI. gives a picture of the nozzle working on this ground.

Besides the places already mentioned as having been worked by hydraulicing, there are several other localities which offer facilities for this method of treatment. Amongst these may be mentioned the ground surrounding the old Bower Bird claim on the tableland, where about 180 acres have been taken up for this purpose, and the ground surrounding the Home Rule claim, near Rossville, where a fine supply of water can be obtained from above the Home Rule Falls, on Slatey Creek, and where, I understand, operations are to be begun as soon as the necessary machinery can be got on the ground.

The greater portion of the ground that has lately been taken up is on the lower flats along Wallaby Creek and the main river. These flats were referred to by Dr. Jack as offering great possibilities, with economical treatment. Up to the present little systematic prospecting has been attempted except in one or two cases, of which I have not been able to get the detailed results. From their position below good tin-bearing ground, these flats, at first glance, show every prospect of carrying payable tin, but it would be impossible to form any definite estimate of their value without elaborate prospecting and a careful consideration of the means to be employed to win the tin in each individual case. The want of sufficient fall seems to preclude the employment of simple hydraulic sluicing in the great majority of cases, and some method of raising the material, either by bucket dredging or by suctioning after hydraulicing, and thus allowing of the wash being carried through a series of boxes of sufficient length and fall to allow of the separation of the tin from the soil, will have to be adopted. The depth of alluvial to be dealt with in much of this ground, as well as the character of the bottom and the prevalence of boulders in a good deal of the ground, are elements of trouble which will have to be considered in any scheme of treatment that is proposed.

DREDGING.

In 1898, an attempt was made to dredge a portion of Wallaby Creek, near Rossville, known as the Native Youth claim, where a wide stretch of alluvial ground is held up by a bar of granite. This dredge was on the suction principle, the breaking up of the ground in front of the suction pipe being effected by means of an ingenious revolving pick actuated by an endless chain from the engine. As far as I ca learn, the whole of the material brought up through the suction pip containing numerous stones and boulders up to the full width of the pipe was passed through the boxes in which it was proposed to save the tin The result was that the rush of water necessary to carry these boulder through the boxes and out behind the dredge was too great to allow o the settling of the tin, and it was found impossible to save it. Th dredge was subsequently washed down the creek by one of the flood incidental to the wet season in this district, and has never bee re-erected.

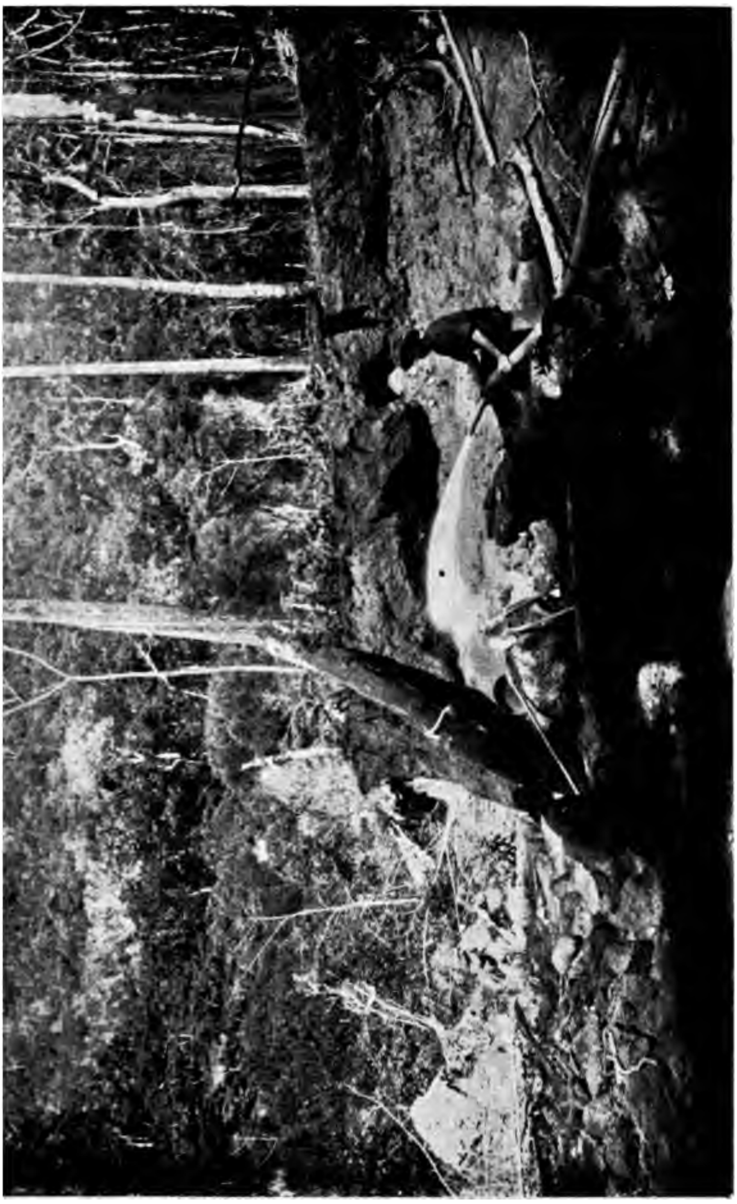
The difficulty of saving the tin is one that has been quite overcome in the Stanthorpe dredges by screening out the boulders on "grizzly" before allowing the wash to enter the boxes, and by havin a sufficient length of boxes to allow of the settling of the tin. Th danger from floods, however, is one which will always have to b guarded against in any scheme that may be proposed for the lowe ground lying along the river and its main tributaries. In view of th numerous difficulties at first experienced in dealing with dredging propositions on the Stanthorpe flats, and the final overcoming of thos difficulties by repeated experiment, I do not think that the drawback incidental to this class of work should prove too great to allow of considerable amounts of tin being profitably worked from many of thes river flats. The necessity, however, of a systematic prospecting of th ground, and a careful consideration of the engineering difficulties to b contended with in each individual case, before incurring a large expenditure in erecting unsuitable plant or attacking ground that canno be economically worked, cannot be too strongly insisted on.

V. THE LODE WORKINGS.

Lode mining was commenced on the Annan Field about 1887, th Warden's report for that year mentioning the fact that lodes we being worked at Mount Amos, Mount Leswell, and the Upper Anna Crushing and dressing machinery is mentioned in the Warden's repor as working at the Lion's Den Mine (Tableland) and at the Collingwo Mine in 1889, and at the Mount Browning Mine in 1890. In the latt year the field was visited by Dr. Jack (then Government Geologis who reported in detail on the work that had been done up to that tim and took a number of samples from the different faces exposed by th workings. Lodes were then being worked at Mount Leswell, Collin wood, Mount Hartley, Lion's Den, Mount Amos, and Mount Brownin the depths, however, being all comparatively shallow.

These mines were abandoned one by one during the next f years, and no serious lode mining appears to have been undertak since. Numerous causes have apparently contributed to this resu the most important being probably the exhaustion of the rich bunches of the more easily won ore near the surface, and the great difficulties involved in profitably extracting the ore at lower leve

Plate VI.



HYDRAULICING RESIDUAL DEPOSITS ON HILL SIDE, YATES'S CLAIM, ROMEO.

Among other causes were, perhaps, the low prices of the metal ruling during the years 1894 to 1898, and the dispersal of the mining population owing to the rich gold finds in New Guinea and on the Starcke River. As the returns of lode tin and stream tin have not been kept distinct, there is no record of the amount that has been derived from these mines; but, judging by the amount of work done, it has not formed any considerable proportion of the total.

MOUNT LESWELL.

The lodes here lie on the western slope of the ridge dividing the head of Baird's Creek, flowing west into the Annan from the head of Jones Creek, which falls north-easterly into Wallaby Creek; and these lodes are now included in Lease 182, shown on the accompanying map. The hill-slopes below the outcrops of the lodes are strewn with boulders of tourmaline-bearing quartz, evidently derived from the lodes. Patches of soil have been worked for the tin shed from the lodes, while the whole hillside is now taken up for the purpose of hydraulic sluicing by the Annan River Company. The workings on the lodes are at present in disrepair.

At the time of Dr. Jack's visit two lodes, called the "Eastern" and "Western" lodes respectively, were being opened up. On the "Western" lode four shafts had been sunk over a length of 130 ft., to a depth of about 35 ft., and were connected by a drive at that depth. Nine samples taken by Dr. Jack along this drive gave, on assay, an average of 4 per cent. of metallic tin. Of these, four samples gave only traces of tin, while two gave over 10 per cent., by which it may be judged that the ore is very uneven in quality. The strike of the lode is about north-west, with a steep dip to the north-east.

On the "Eastern" lode two shafts were sunk to a depth of about 50 ft. each, a distance of 40 ft. apart, and connected by a level at that depth. Nine samples from this lode gave only traces of tin, while one sample gave over 21 per cent.

These lodes are described as consisting of tourmaline and quartz in granite, and as reaching in places to a width of 4 ft., though they are evidently very irregular both in thickness and value. There is no record of the return of ore or metal from the workings on them.

THE COLLINGWOOD LODE.

This lode, situated near the source of Jones Creek, on the eastern fall of the Collingwood Range, is now embraced in Lease 176, the position of which is shown on the map. At the time of Dr. Jack's visit four shafts had been sunk on it over a length of about 200 ft. to depths varying from 35 to 50 ft. Crosscuts from these shafts exposed a lode of tourmaline and quartz of considerable width, dipping with a flat inclination into the hill and lying at the junction of granite and metamorphic rocks. Ten samples taken by Dr. Jack from various parts of the lode in 1890 gave an average of 3·75 per cent. of tin. Of these samples, however, only three gave over 2 per cent., the highest result being 19·40 per cent. These results indicate the very uneven value of the lode material. The apparently great width of the lode, however, should make it worth further prospecting. At the present time nothing is being done in this direction, though the present holders intend to commence work as soon as their sluicing works are in fair working order.

THE LION'S DEN LODES.

These lodes are embraced in Lease 186, shown on the map, and are situated on a spur coming down from the Tableland between the two main branches of Mungumby Creek. Several parallel veins in granite have been worked opencast, and irregularly, wherever good tin could be got, much of the material having been hand-dollied and streamed. The residual surface deposits have been all removed and sluiced over a considerable area down the slope of the spur.

At the time of Dr. Jack's visit in 1890 the main lode had been worked by two vertical shafts, situated 97 ft. from each other, in a north and south direction, and connected at a depth of 60 ft. by a level along the lode. The lode was intersected by a cross-tunnel from the side of the hill, at a point 34 ft. north of the northernmost shaft, and the level was continued on south of the two shafts along the lode for a distance of 378 ft. beyond the southernmost shaft. All the payable ore between the tunnel and the southern shaft above the 60-ft. level—*i.e.*, for a length of 130 ft. along the line of lode—had been stoped out, crushed, and concentrated.

The mill was situated close to the mine, and was actuated by a Pelton wheel, driven by water flumed from Byers Creek. The amount of stone crushed at the time of Dr. Jack's visit was 539 tons 3 cwt., for a return of 48 tons 16 cwt. of black tin, giving an average of about 11 per cent. The average width of the reef would thus appear to have been about 1 ft., on the supposition that all the stone came from the stopes between the tunnel and the shafts.

A winze was sunk on the lode, 20 ft. north of where it is intersected by the tunnel, to a depth of 44 ft., but Dr. Jack states that it could not be inspected at the time of his visit. Since then there is no record of any serious mining having been undertaken, though a certain amount of surface prospecting of the other veins was carried on.

This would appear to have been the most remunerative of the lodes worked on the Annan Field, and is the only one of which there is any record of the amount of stone crushed.

THE MOUNT BROWNING LODES.

These lodes are situated on the eastern slopes of Mount Amos, about a mile and a-half from the sea coast. They are included in Lease 189, the position of which is shown on the map, and are known to the present owners as the Phœnician. The lodes occur in granite country close to its contact with a mass of slates and quartzites. The lodes crop out down the rocky slopes of the mountain as irregular patches of tourmaline and quartz occurring along regularly-running joint planes of the granite. They are no doubt the result of alteration of the granite walls of the joints by mineralising vapours introduced from below during the consolidation of the margin of the granite mass in cooling.

These lodes were being worked at the time of Dr. Jack's visit in 1890, and several tunnels and shafts are described in his report. The majority of these have now fallen into disrepair, and it is somewhat difficult to identify those that can now be inspected with Dr. Jack's descriptions. During the first few months of this year a little desultory prospecting has been carried on by a Brisbane syndicate, but up to the time of my visit little had been done in the way of further development of the ore bodies.

Dr. Jack refers to several "pipes" of ore above the old mill site and camp, from which he took eight samples of ore. These samples gave, on assay, an average return of nearly 10 per cent. of metal. A shaft, 35 ft. on the "Upper," or No. 5, lode, and a drive 35 ft. north from the bottom showed a shoot of stone about 23 ft. in length, which on being stoped up gave 100 tons of ore. There is no record of the amount of tin obtained from this stone, and the bottom of the shaft cannot now be inspected. A small heap of ore stacked on the surface gave, on being sampled by the writer, no return of tin. A tunnel about 100 ft. lower down the hill meets a second lode in about 20 ft. The lode has been driven on about 12 ft. either way to north and south. The southern face shows about 3 ft. of lode formation, carrying quartz and tourmaline, from which a good prospect of tin was obtained.

The face of the northern drive shows lode material, heavy with tourmaline, over a width of about 6 ft. Patches of coarsely crystalline cassiterite occur along the hanging-wall, but a sample taken right across the face gave no return of tin when assayed at the Government Chemical Laboratory.

About 400 ft. below this tunnel a second tunnel has been driven into a face of rock a distance of about 30 ft. It passes near the entrance from slates into granite. This work was apparently done with the view of cutting a small vein of ore exposed in a shallow shaft some 40 ft. up the hillside. Patches of tourmaline are seen on the roof and walls of the tunnel, but I could not see any indication of a defined lode or vein. About 30 ft. further west the slates have been bared off from the granite, exposing a vein of tin running along the junction of the two rocks. The presence of this vein of ore is traceable to the influence of a joint seam passing into the granite at right angles to its junction with the slate, and along which tin ore can also be seen. This latter vein of ore along the joint has been opened up by a shaft

60 ft. further south, and about 40 ft. up the hillside by a vertical about 9 ft. in depth. It shows a vein having a width up to 12 in. the ends and in the bottom of the shaft. About 1½ tons of goo ore have been raised from this shaft.

It will be seen from the above that as yet very little work been done on the lodes, and that what has been done shows that t is good tin ore in some of them. The quality of the ore, howeve very uneven, and the shoots appear to be short, the ore b occurring in "pipes" along joint planes, as pointed out by Dr. Jac his report. Under these circumstances a great deal more develop work will have to be done before even an approximate idea of value of the lodes can be formed. Judging from the exposures as made, some good patches of ore may be expected to be found, b is extremely doubtful whether the lodes are capable of turning any large quantity of crushing stuff. The ore so far developed se to be more adapted to a system of hand-picking and simple inexpensive concentrating on a small scale than to treatment by elaborate methods.

VI. THE ALLUVIAL WORKINGS.

An attempt was made in previous pages to give a general ide the character of the alluvial deposits of the Annan Field. The foll ing paragraphs will describe the various claims and leases in as detail as the time spent in examining them permitted. It is a ma for regret that these examinations were not made more detailed, to do that would have involved a very much greater length of t than could be devoted to the work. At the date of my visit country was practically uncharted, and it was consequently v difficult in such mountainous country to arrive at an understanding the interdependence of the different features and exposures met w The study of the field was also somewhat interrupted by calls to ot work.

(1.) The Upper Annan.

Romeo.

The workings here lie scattered up the numerous tributary cre of the Romeo branch of the Annan River. The Romeo branch he from a scrub-covered mountain, which I have named on the map Mount Yates, and which forms the culminating point of Yorke Range shown on the Lands Office map of the district. The Rom branch flows north-westward from here past the now almost desert township of Romeo, and forms one of the main heads of the Annan.

On the crown of a ridge near its source is ***Yates's Claim***, whi has been worked as continuously as the supply of water would all for some fifteen or sixteen years. The ground here consists of resid deposits lying on the crest and down either side of a scrub-cover ridge, the depth of soil running from about 2 ft. to 6 ft. in thic ness.

The bulk of the tin has been found in coarse, rounded lumps, getting finer as the lower ground in the various gullies was reached. The floor from which it has been washed shows numerous veins of decomposing porphyry traversing the granite. Alongside of these veins, I was informed, good tin was often got, and the presence of the tin in the surrounding soil is no doubt in great part due to their influence. The claim is at present being worked by hydraulic sluicing along the lower slopes of the ridge about 100 ft. below the summit. This method of working has only recently been applied, and has proved a great saving of time and labour compared with the method of ground sluicing. (Plate VI. gives a picture of the present face.)

The water is brought by means of a race from a distance of about four miles. The source of supply is Granite Creek, falling into the Bloomfield River; and the race has been carried over the divide between it and the Annan waters to the left bank of Romeo Creek. It is then piped across the head of Romeo Creek, the pipes being carried on trestling standing 27 ft. above the creek bed, and rising at the further end to a height of 122 ft. above their lowest point. The pipes are galvanised steel, 4 in. internal diameter, 17 ft. 9 in. in length, and weigh 43 lb. each. They were brought by dray from Cooktown to within about a mile of the work, to which they had then to be carried up by hand some 600 or 700 ft.

The pipes empty into a ditch, which carries the water into a wooden box, into the bottom of which the pipes leading to the nozzle are fitted. These pipes taper from a diameter of 6 in. to 2½ in. at the lower end, where they are attached to 20 ft. of rubber hose terminating in a nozzle ⅞-in. in diameter. The vertical height from the box to the nozzle is about 100 ft., and this height gives ample pressure for breaking down the ground.

The proprietor estimates that he can move about 40 loads of material per day, and that for 15 weeks' work he obtained 32 cwt. of tin, equivalent, at present prices, to about £175.

Near the old township are situated *Wilson and Muir's* and *Mahoney and Sullivan's* claims, on Baird's Creek and Kimberley Creek, just above their junction with Romeo Creek. A bar of granite across the Romeo branch below the point where it is joined by the two former creeks has allowed of the formation of a terrace stretching up between the two creeks for a distance of about 300 yards by about 150 yards across. This ground has been worked for the last 20 years, at first by stripping and box sluicing, and subsequently by ground sluicing, with water brought in from about a mile up Romeo Creek.

On Wilson and Muir's ground, on Kimberley Creek, the face is now about 20 ft. in height, and the bottom is beginning to rise rapidly, while the tin is getting poorer, so that the terrace is nearly worked out. Mahoney and Sullivan have worked out the corner of the terrace on their ground abutting on Baird's Creek, and are now working over old ground in the bed of the creek a few hundred yards further up. Plate II. shows the present aspect of Wilson and Muir's claim, and gives some idea of the character of the ground and method of working it.

There are several claims working the bed of the Romeo branch below the falls at Romeo, and about two miles of the river have been taken up as a dredging claim. The river here flows between rocky banks, which hem it in closely on either side, and have allowed of little room for the accumulation of terraces of tin-bearing gravel except towards the lower end. Here a flat of about four or five acres in extent seems to offer good prospects of carrying payable wash.

Grasstree and Jackeroo.

Grasstree Creek is a short tributary of the main branch of the Annan River about a mile due north of Romeo. The alluvial ground here has been formed behind a bar across the creek a little above its junction with the river. The creek was formerly worked along its bed by stripping and boxing. Recently the ground has again been taken up by Bolen and Bathe, who have succeeded, after many difficulties, in bringing water on to the ground. The water is turned from the Annan River by a dam, a picture of which is shown on Plate IV.

From the dam the water is led through 20 chains of fluming, part of which is shown in the picture, then by four chains of race to piping, which carries it across the valley of Stoney Creek. There is 1,800 ft. of this piping. The pipes are 6 in. in diameter, of spiral rivetted steel, and had all to be packed and carried up from the Bloomfield River over Stuckey's Gap, a height of about 1,300 ft. above the sea. The next 800 ft. is box piping, 7 in. by 6 in. square. Unfortunately the claimholders were not financially strong enough to carry their steel pipes right through, and laid this wooden piping, with a rise of 33 ft., to the outlet, thus giving a pressure of over 15 lb. to the square inch. This was too much for the wooden pipes, which burst as soon as the water was led through them, thus entailing considerable delay and expense in raising the piping from the lowest point to give a rise in the box piping of only about 3 ft.

The pipes deliver into a reservoir 40 ft. by 50 ft. by 8 ft. deep, cut in a granite soil on the crown of a ridge. From here it is distributed to the three faces at present being worked. The water supply to these workings was completed about the end of May last, and for the first five weeks after starting to work four men cleaned up 25 cwt. of tin, worth about £125, which thus gave them over £6 per week per man.

The low grade of fall of the creek for some distance above the bar of granite behind which the tin-bearing ground has been formed retards the getting away of the tailings. This has been obviated to

Plate VII.

some extent by cutting a channel 5 ft. deep by 1 ft. in width for a length of 2½ chains through the solid granite bar, but even this gives hardly sufficient fall to allow of expeditious work, and the claimholders intend to lower it another 6 ft. or 7 ft. as soon as they are in a position to do so.

Stoney Creek and Jackeroo Creek join each other about half a mile before reaching the river, which they enter about a quarter of a mile above Grasstree. Along these creeks are several claims, all working in dense scrub. Stretches of alluvial lie along the beds of the creeks, separated by rocky bars. As a rule, they are not of any great width, though immediately below the junction of the two creeks, and about a quarter of a mile above the junction with the Annan, there is an area of about 40 acres where several tributary creeks enter Stoney Creek. This area has been taken up for dredging purposes as the Lindsay No. 2 Dredging claim. The alluvium is here in places as much as 6 ft. in depth. It appears to be well suited for treatment either by hydraulicing or dredging.

Further up along Stoney and Jackaroo Creeks another 100 acres have been taken up in narrow strips, along the creek beds. This ground shows every indication of carrying good tin, and of being suitable country for hydraulic work. It does not appear, however, to have been systematically prospected.

Finnigan's.

The ground worked here lies down the western slopes of Mount Romeo. The mountain is marked thus on the Lands Office two-mile map of the district, though it is not generally known on the field by that name. The workings are reached by a track branching off from the main Bloomfield track near Shipton's, on Parrot Creek.

The greater part of the work has been done along the course of a creek draining down from the mountain side, where its fall has flattened to some extent and has allowed of the deposition of about 10 acres of rough bouldery wash. This ground has been practically all worked out, though two men are again turning over the old bed of the creek and getting tin.

Higher up the mountain side an area of residual soil, lying on a slope of about 30°, has been opened up of late years, and is now being worked successfully. This has been rendered possible by bringing in water from higher up the mountain side. This was accomplished by Bolen and Bathe, of Grasstree, by the erection of light fluming tapping the sources of creeks falling towards Grasstree. The length of the fluming is about 116 chains to the storage dam, above the workings. The height of the intake of the fluming is given as 3,300 ft. above the sea-level, while that of the dam above the claim of Rainer (the present owner) is given as 2,200, showing a drop of 1,100 ft. in the 116 chains, or an average fall of 1 in 7.

The arduous character of the work involved in the construction of this race by two unskilled men may be judged from the fact that the 1,500 superficial feet of planks used in its construction had all to be pit sawn on the mountain side, and carried along the race to the points where they were required.

The sizes of the boxes are 6 in. at the bottom, with 5-in. sides, the great fall allowing of such a small section of flume carrying ample water for the work.

It was mentioned previously that an unsuccessful attempt was made to sluice the ground under hydraulic pressure with the water from this flume. The failure was ascribed to the number of boulders present on the wash. As the pressure employed, however, was only about 25 ft., this method of working can hardly be said to have had a fair trial. As a much greater pressure could be easily arranged for, the great slope of the ground should render it eminently suitable for hydraulic sluicing.

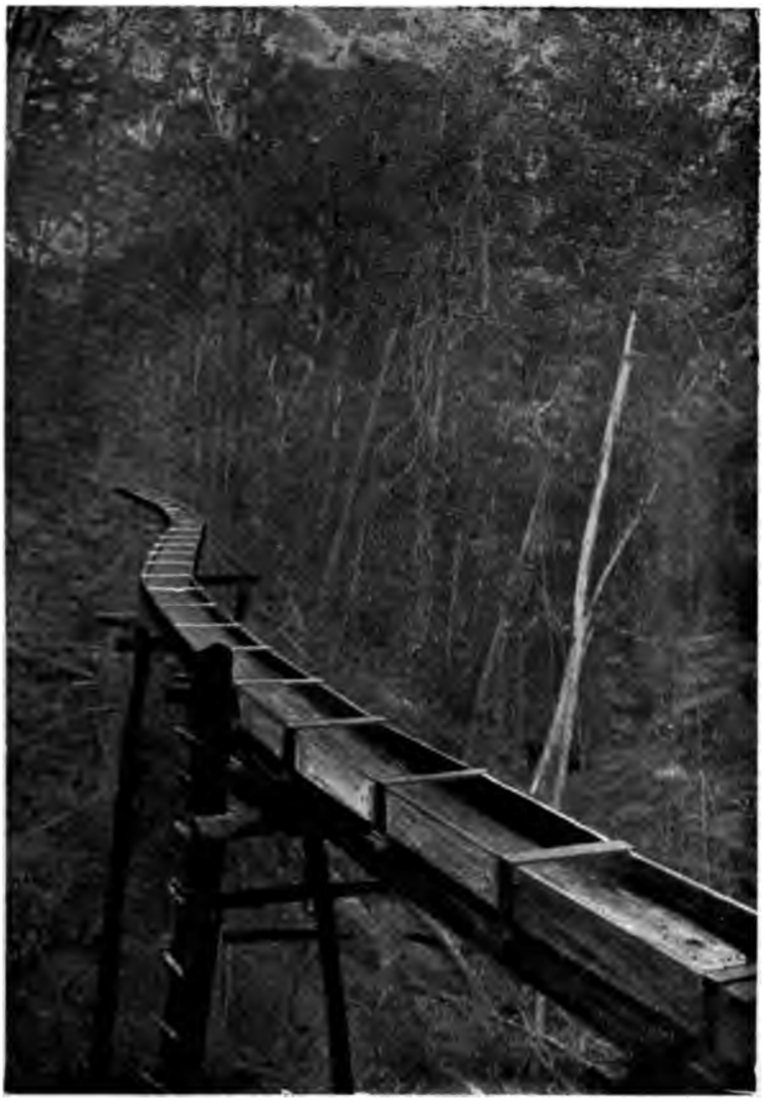
Shipton's.

The workings here lie along tributary streams draining into Parrot Creek about half a mile above the point where it joins the main branch of the Annan River at the Little Forks, and about the same distance east of the main Bloomfield track. This junction is about half a mile above that of the Romeo branch, but Parrot Creek comes in on to the right bank. For about half a mile above the junction Parrot Creek runs through a rocky channel, being hemmed in on both sides by steep banks. Above this point the valley widens out for another mile, the creek winding through an alluvial flat, which has lately been taken up as a dredging claim of about 100 acres, known as the Lindsay Dredging Claim. The country here is slate, the softer character of which has allowed of the more rapid erosion of the bed of the stream, with a consequent corrasion of its banks and accumulation of wash and alluvium.

Several claims lie round the margins of the alluvial flat, amongst which the two most successful have been Shipton's and Spargo's, on the northern edge, on tributary gullies draining down from Mount Walker. The water was first brought on to this ground some eighteen months ago by the Shipton Bros., the cost of construction of the race leading from the falls higher up the creek having been subsidised by the Government. The amount was all repaid within a few months of the commencement of sluicing, and since then this claim has proved very remunerative.

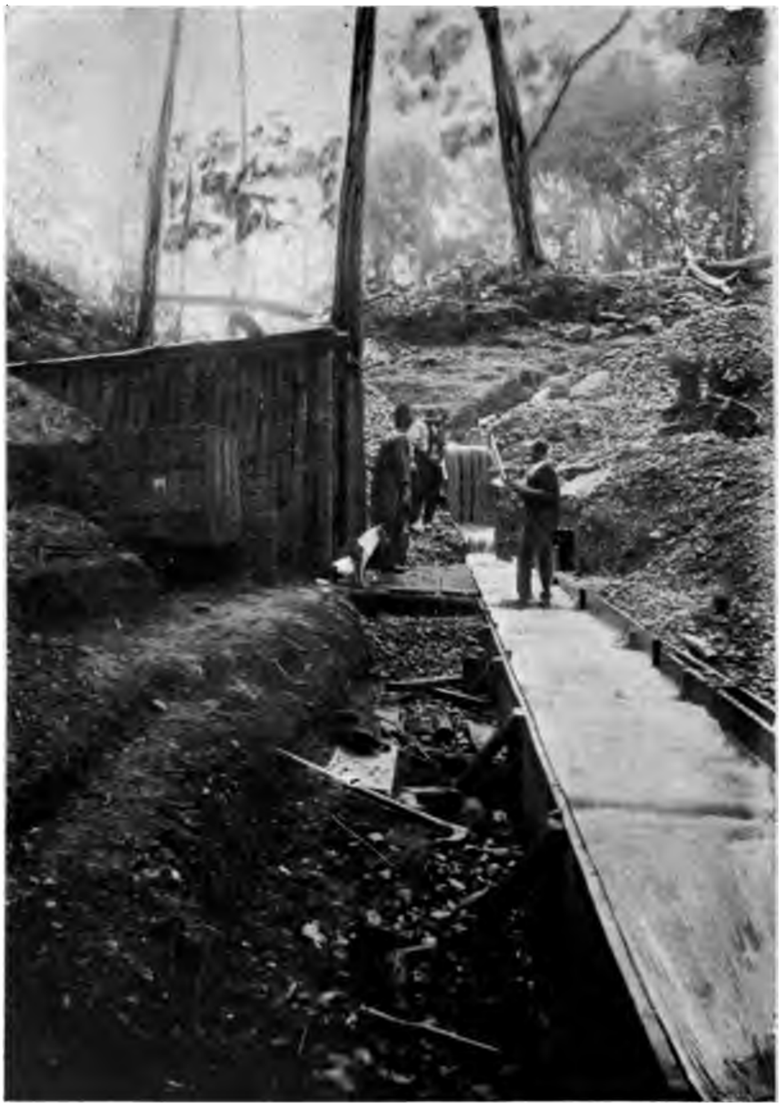
The high quality of the ore obtained in this locality is remarkable, a great quantity of light-coloured tin, some of it almost white in colour, being present. The flat presents features which point to its suitability for bucket dredging, and there seems to be every likelihood of its carry-

Plate VIII.



FLUMING IN DENSE SCRUB, ANNAN RIVER COY.'S RACE.

Plate IX.



TIN-SAVING BOXES BELOW HYDRAULIC WORKING, ANNAN RIVER COY., LESWELL.

ing payable tin. A number of prospecting holes have been sunk at different places on the flat, exposing a rough bouldery wash at the bottom, and the results are reported to have been encouraging.

(2.) THE ANNAN RIVER COMPANY'S HYDRAULIC SLUICING WORKS.

This company has secured an area of about 80 acres of residual deposits at the head of Baird's Creek, flowing into the Annan, and another 150 acres across the divide about the sources of Jones Creek, which flows into Wallaby Creek above Rossville. Hydraulic sluicing has been commenced on the former piece of ground known as the Leswell Lease, which lies immediately below the old Leswell Mines. The ground consists of detritus lying on the hillside, where the slope has been sufficiently flat to allow of its accumulation. Much of the tin contents have no doubt been derived from the disintegration of the veins of ore worked in the old Leswell Mines and other veins of similar character.

The compact nature of the ground to be worked and the mass of boulders and stones of all sizes to be dealt with are proving a source of considerable trouble. During the first seven weeks about 8,000 cubic yards of material were shifted, and gave a return of 5¼ tons of tin. It is hoped that as things are got into better working order greater progress will be made.

The water for sluicing operations is brought from one of the heads of Parrot Creek, a distance of about seven miles, through very rough scrub covered country, where the character of the ground necessitated the construction of a considerable amount of fluming.

Plate VII. gives a picture of the dam and sluice gate, by means of which the water of the creek is turned into the race; while Plate VIII. is a picture of part of the fluming. The nozzles are worked under a pressure of 240 ft., and the race has sufficient capacity to keep two 2-in. nozzles working when running half full.

The leases on the Collingwood side have so far not been tried. I understand that the prospects in this ground are also very encouraging. Plate IX. gives a picture of the sluices-boxes in which the tin is saved, and shows in the background a portion of the ground already worked. An idea of the character of the ground to be dealt with may be gathered from Plate V.

(3.) WALLABY CREEK.

Native Youth and Hatfield's Claims, Rossville.

These claims lie near the junction of Jones Creek with Wallaby Creek. Immediately opposite the Rossville Public House, Wallaby Creek flows over a bar of granite, above which the creek and its numerous tributaries draining down from the Collingwood Range and the Bald Pocket have deposited a wide stretch of scrub-covered alluvium. The boundaries of this ground are roughly indicated by t area shown on the map as having been taken up in dredging clain This area narrows as the main creek is ascended, but extends up beyo the junction with Slatey Creek, a distance of about three miles abo Rossville.

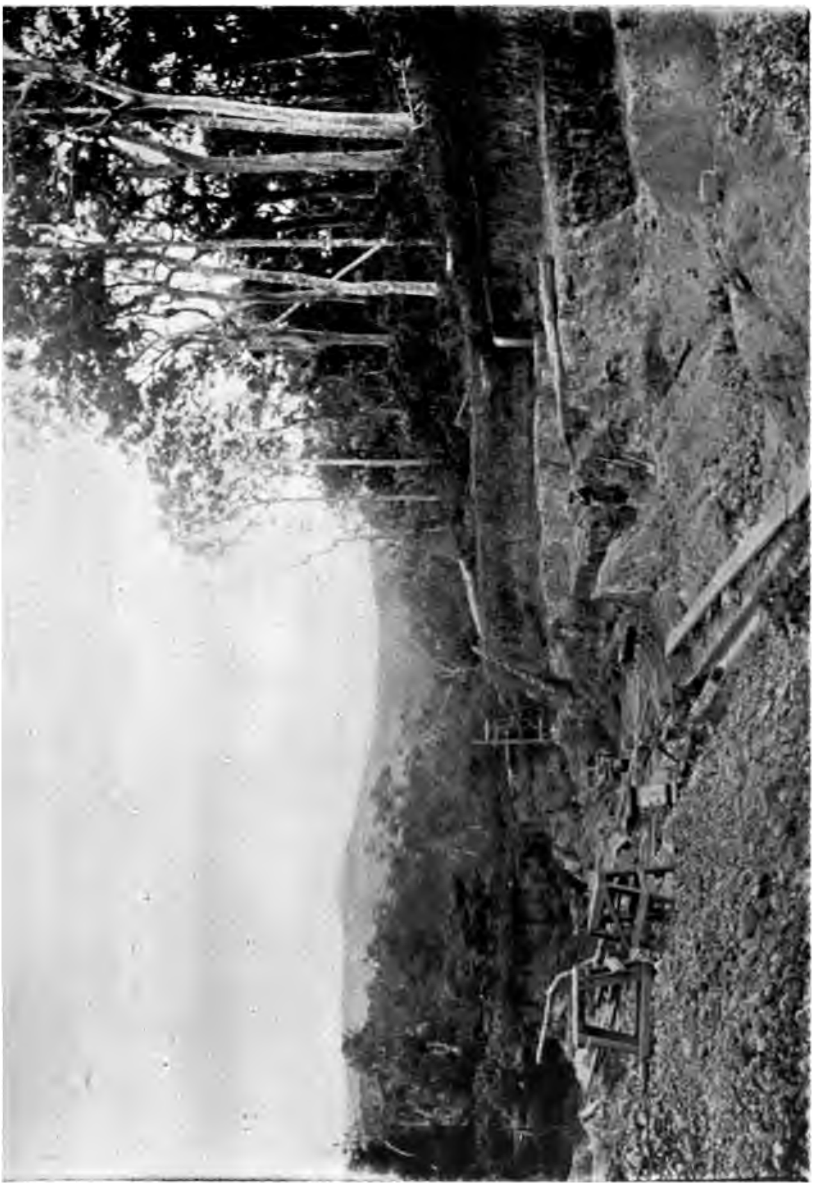
The granite bar was cut through in 1892 by a channel 7 ft. de and 8 ft. wide, and for a length along the bed of the creek of abo eight chains. This work, by reducing the level of the water in t creek bed, has allowed of the working of the gravels underlying t alluvial ground higher up to a correspondingly greater depth. Ev now, however, there are deeper holes which have to be bailed duri the dry seasons to allow of the gravel being lifted into the grou sluices. The depth of alluvium in these claims runs up to nearly 20 f and involves the use of a correspondingly great amount of water remove the overlying poorer drift before the wash can be treated.

Plate X. gives a view of the Native Youth claim, on Wallal Creek, while Plate XI. gives a picture of Hatfield's claim on Jon Creek, immediately above its junction with Wallaby Creek. T country surrounding and lying above these claims has been taken with a view of working it by more economical methods. In 1898 attempt was made to dredge the ground immediately above the ba but, from causes explained before, this project was a failure. T depth of alluvium and the numerous boulders to be dealt with, as w as the liability of this locality to destructive floods, against which will be extremely difficult to protect any form of floating dred seem to point to the necessity for some more manageable meth of attacking the problem. Probably some form of hydraulicki the face would be most suitable. In this case, however, the enormo amount of tailings to be got rid of and the want of sufficient fall wou have to be considered, and would probably necessitate the elevating the material to be washed, by some form of suction pump, to a co siderable height above the bed of the creek.

Kerr Brothers and Yateman's Claims.

These claims are situated on the spurs of the ridges betwe Jones and Byers Creeks and have been among the best claims in t district. The ground lies well above the present level of Jones Cree and is apparently the result of a former system of drainage when t bed of Wallaby Creek was at a considerably higher level than it is present. As the bed of Jones Creek became eroded back by cascad and falls to its present depth these alluvial terraces would appear have been left at the higher level. They have subsequently been c into by cross channels of drainage coming down the hillsides till th are now found occupying the points of the spurs between these wat courses.

Plate X.



NATIVE YOUTH CLAIM, WALLABY CREEK, ANNAN RIVER.

Plate XI.

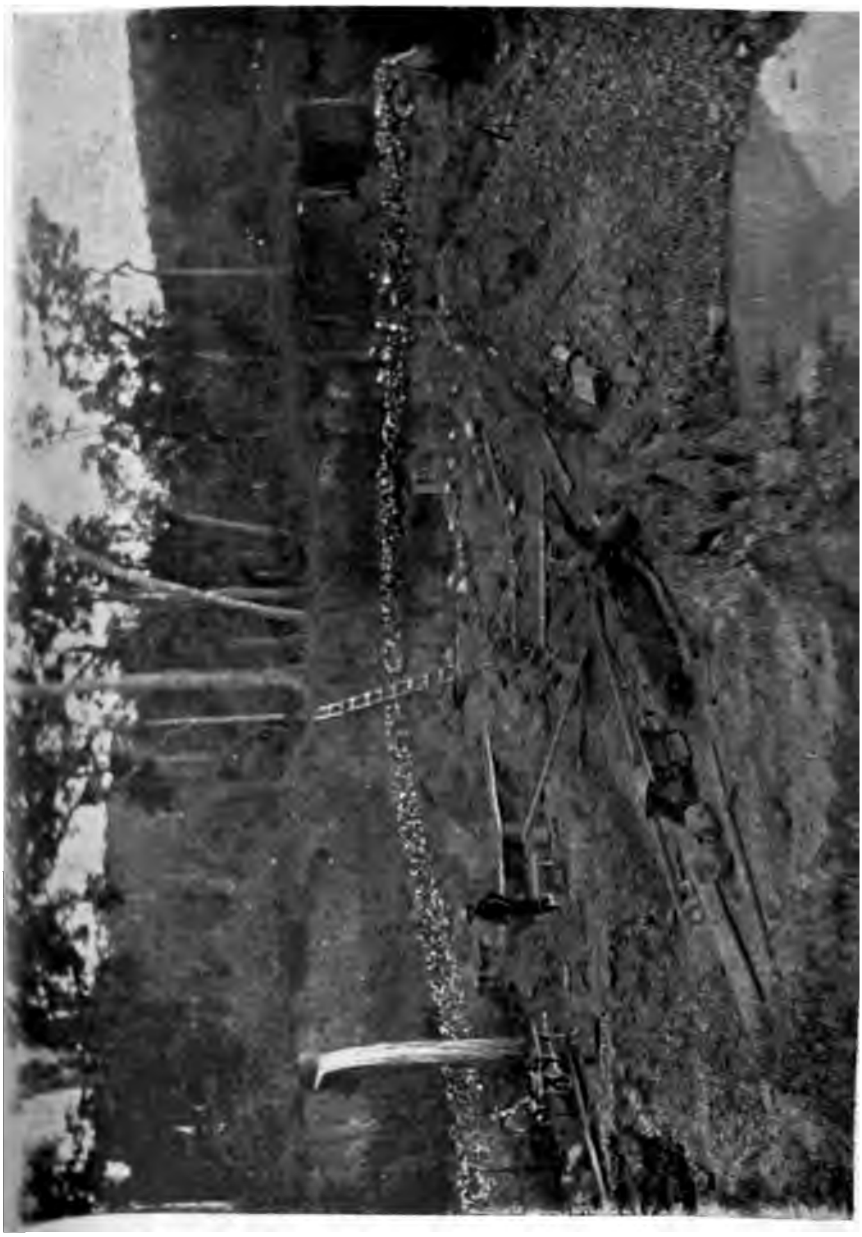


Plate XII. is a picture of Yateman's claim, showing a depth of face of about 15 ft. in the middle, the surface of the wash sloping away on either side towards the present water-courses. The floor of the wash meanwhile presents a gentle slope towards the right in the direction of that of the drainage, by which it was left behind. This claim has been worked up from the point of the spur for about 150 ft., but the ground is now beginning to rise rapidly and the edge of the rock bed on which the alluvium was laid is found cropping out a few yards further up the hill.

Kerr's upper workings on the adjoining ridge show the same general features.

The Home Rule Claim.

This claim lies on a branch of Wallaby Creek about a mile and a-half above Rossville, in dense scrub, and has only been opened out within recent years, during which time it has proved very remunerative to the three owners. The face here is about 12 ft. in height, and the comparatively large amount of fall has allowed of very economical working. The water is brought in from above the Home Rule Falls, on Slatey Creek (a picture of which is given on Plate I.), a distance of about a mile. Some of the fluming for this race had to be built round the face of a perpendicular cliff, the men engaged in the work having to be swung over the edge of the cliff by ropes in order to allow of supports being driven into the rock to carry the fluming.

The claim has recently been acquired by an Adelaide company, which proposes to hydraulic the ground under pressure, for which they should apparently have sufficient height and volume in the supply already available. Plates XIII. and XIV. give a representation of the character of ground in the Home Rule claim.

About 700 acres of ground have been taken up as dredging claims on either side of Wallaby Creek, running for a distance of about a mile above Rossville, and embracing the flats on either side. This ground has, I understand, recently been thoroughly prospected by numerous bore holes, but I have not been able to learn in detail what results were obtained.

Dick and Coutts's Claim.

This is an area of creek wash lying on the old Bloomfield track about three miles from Rossville, a tributary of Wallaby Creek. The ground is about 10 acres in extent, and through it the creek winds in a tortuous course, the alluvial ground being hemmed in by steep banks on either side. The alluvium is held up by a bar of granite, which has allowed of the corrasion of the banks of the stream above it, and the consequent deposition of wash and alluvium in its bends. The ground has been worked here and there in pockets, whenever the season has been dry enough to allow of the wash being reached. Good tin is reported to have been got. The present owners are cutting a channel through the granite bar, by which they hope to lower the water some 7 or 8 ft., and thus reduce the level of the water in the ground above. They then propose to bring in a race from higher up the creek, and either ground sluice or hydraulic the ground.

(4.) TABLELAND AND MOUNT AMOS.

The Tableland workings are situated along the source of Mungumby Creek, which flows due west from here to join the Annan River near Helenvale Public House, the workings being about four miles due east of the junction. The pack track goes up the creek flats from the public house for about two miles, and then rises rapidly to a height of about 1,700 ft. above the sea. The workings are scattered along the upper course of the main creek, and on numerous gullies draining into it from the south. At present the only work being carried on is along the main creek, which has been worked by ordinary ground sluicing for a length of about a quarter of a mile.

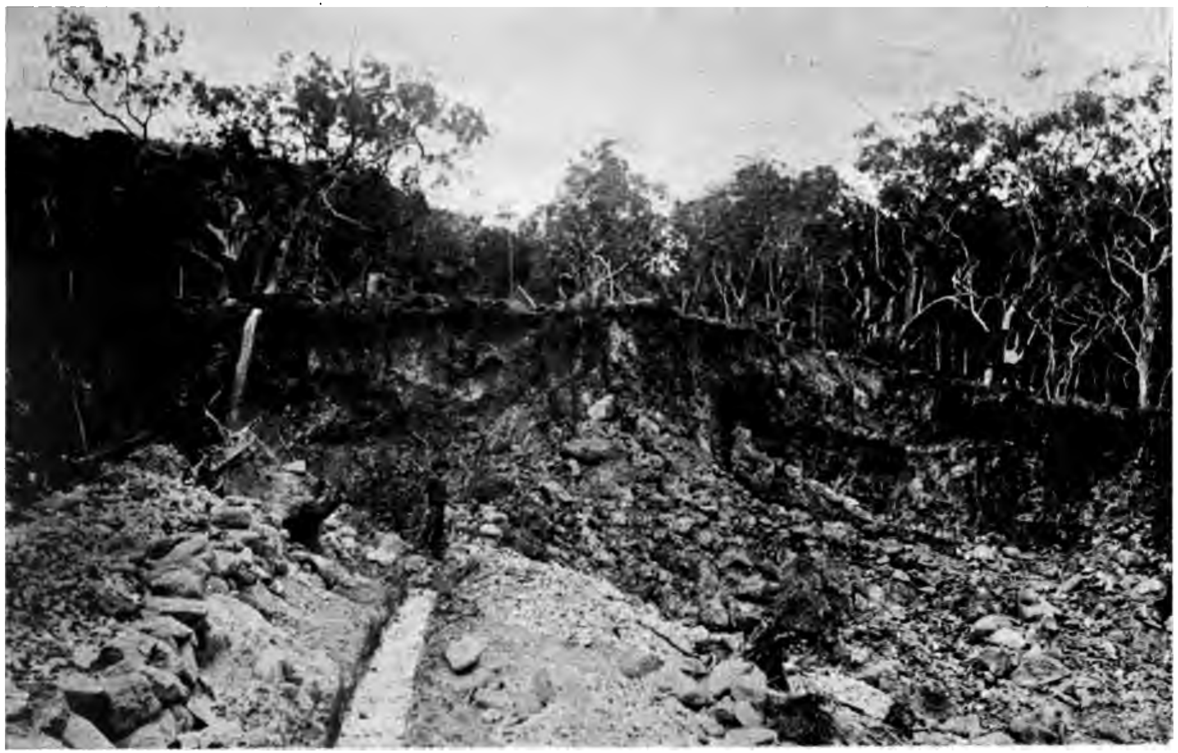
This ground occurs above a bar of rocks, over which the creek runs in a series of cascades and falls for about another mile, till it plunges at the Falls into the valley below. About 180 acres of thick scrub land, lying along the sources of numerous gullies to the south of these workings have been taken up as the Adelaide and Bower Bird Dredging claims, with the intention of installing a hydraulic sluicing plant to economically treat the poorer material left along the gullies by the early fossickers and the surface soil. The water will have to be pumped from a dam on the main creek, but the shallowness of the overburden and splendid facilities for disposing of the tailings, owing to the rapid fall of the ground to the west of the tin-bearing ground, should allow of very economical treatment.

In the lower valley of Mungumby Creek, below the Tableland workings are wide flats of alluvial ground which apparently have not yet been prospected. They show from their position below good ground every probability of carrying tin, but the level character of the ground on which they lie has probably proved an obstacle to their being successfully dealt with by ordinary ground sluicing.

At Mount Amos numerous stretches of good alluvial ground lie along the lower slopes of the mountain, in positions eminently suitable for ordinary ground sluicing. Owing, however, to the proximity of the ground to the sources of drainage, the supply of water fails comparatively early in the year.

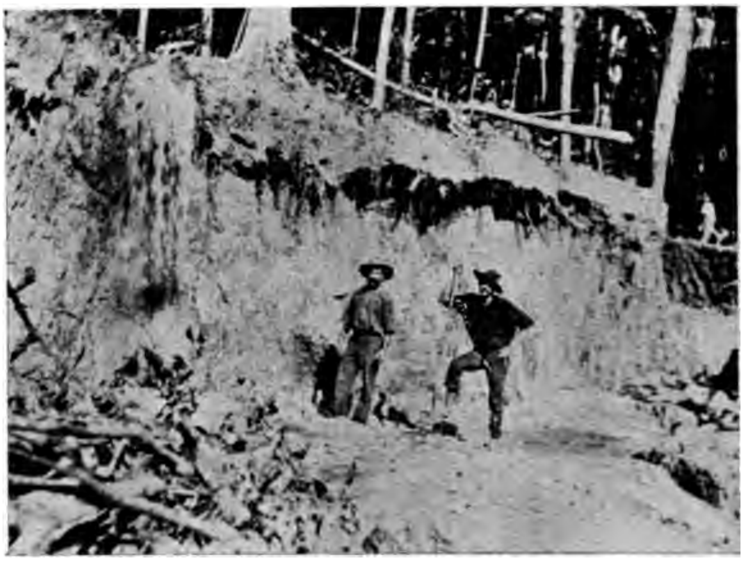
The best claim is Archbold's, situated on the site of the old township, this claim having been worked continuously since the first discovery of tin in the district. The ground worked here occurs as an elevated terrace on the southern bank of Waterfall Creek, which falls into the sea about a mile further north. Perhaps a quarter of an acre of ground has been worked out here, the face at the top end of the

Plate XII.



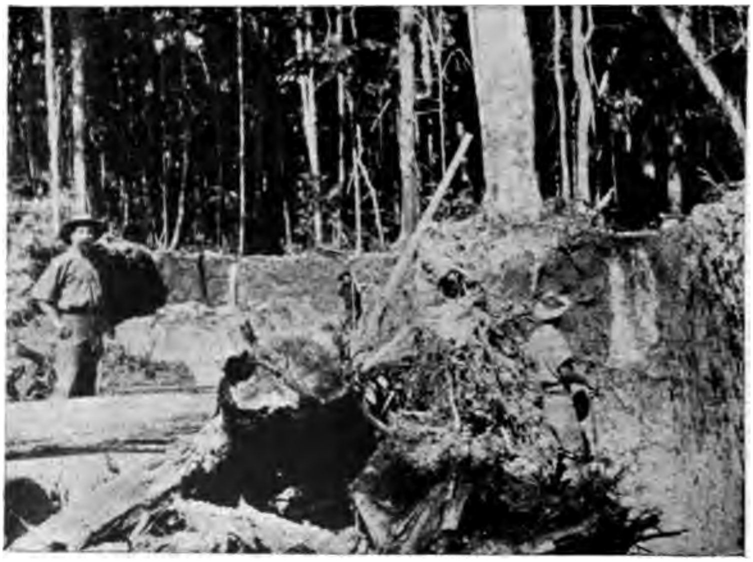
OLD ALLUVIAL IN YATEMAN'S CLAIM, NEAR ROSSVILLE.
SHOWING FALL OF SURFACE ON EITHER SIDE OF RIDGE.

Plate XIII.



WORKINGS ON HOME RULE TIN CLAIM.

Plate XIV.



WORKINGS ON HOME RULE TIN CLAIM.

ground being some 12 ft. in depth and carrying numerous boulders and stones. Below this ground, bordering the present bed of the stream, is an area of alluvium of a lower terrace, to which attention is now being turned, and which is proving remunerative.

VII. CONCLUSION.

It will be seen from the above account, and from a glance at the accompanying map, that rich alluvial tin occurs at numerous points over an area of country some twelve miles in length by eight miles in breadth, its boundaries conforming roughly with those of the intrusive granites. These alluvial deposits have been worked hitherto mainly without the employment of any engineering skill except that incidental to the construction of races and fluming to bring water in from some higher source over the face of the material to be dealt with. Of late years, however, piping has been employed in one or two instances to carry the water over intervening depressions, and hydraulicing the face with water under pressure has been resorted to. In one case only up till within quite recently has any attempt been made to deal with the alluvial deposits by machinery by dredging the alluvial flats above Rossville, this attempt having been rendered abortive by want of knowledge of the difficulties of saving the tin and by the destruction of the dredge by floods.

Within the last year one elaborate scheme for treating the alluvial deposits on a more extensive scale has been completed at Leswell, and is working more or less satisfactorily, while two other schemes—that at the Home Rule claim on Wallaby Creek, and that on the Adelaide and Bower Bird leases on the Tableland—are in a fair way to commence work, the machinery having already been landed at Cooktown. Other areas in the immediate neighbourhood of the present workings show prospects of becoming remunerative with the adbption of more economical methods of working.

The creeks on which these workings lie all drain westward into the Annan River. Besides the deposits lying along them, and already more or less proved by numerous workings, some 1,000 acres of alluvial flats extending for 15 miles along the Annan River itself have been taken up. Apparently no attempt has been made to prospect these flats, but their position holds out every prospect of their carrying good tin. Their possibilities in this respect were pointed out by Dr. Jack in his report issued in 1891 after a visit to the field. The engineering difficulties connected with the treatment of this ground may be considerable, but they do not seem to be more formidable than those already overcome in other parts of the world.

Brisbane, 28th October, 1906.

By Authority: George Arthur Vaughan, Government Printer, William street, Brisbane.

Queensland.

DEPARTMENT OF MINES.

Queensland Geological Survey.

PUBLICATION No. 311.

STANHILLS TINFIELDS.

(NEAR CROYDON.)

[WITH TWO PLANS AND THREE PHOTOGRAPHS.]

By B. DUNSTAN, F.G.S.,
ACTING GOVERNMENT GEOLOGIST.

BRISBANE:
BY AUTHORITY: GEORGE ARTHUR VAUGHAN, GOVERNMENT PRINTER, WILLIAM STREET.

1907.

Queensland.

DEPARTMENT OF MINES.

Queensland Geological Survey.

PUBLICATION No. 211.

STANHILLS TINFIELDS.

(NEAR CROYDON.)

[WITH TWO PLANS AND THREE PHOTOGRAPHS.]

By B. DUNSTAN, F.G.S.,
ACTING GOVERNMENT GEOLOGIST.

BRISBANE:
BY AUTHORITY: GEORGE ARTHUR VAUGHAN, GOVERNMENT PRINTER, WILLIAM STREET.
1907.

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Stanhills Tinfields.

(NEAR CROYDON.)

◆

GENERAL FEATURES.

Stanhills, the name given to a tinfield situated between twelve and twenty-four miles to the south-east of Croydon, on the Croydon-Esmeralda Road, was at one time considered to have a very promising future, but subsequent developments failed to realize the expectations of those interested in the matter, and, in consequence, the field was abandoned. More recent operations, however, have revealed ore of exceptionally rich quality, and again the field has become very active.

The north-eastern edge of the field lies close to the Alluvial Springs at Moonlight Creek, about twelve miles south-east of Croydon, where the tin is found in an alluvial deposit associated with Desert Sandstone, the other end of the field being about twenty-four miles in the same direction from Croydon. North and south of the Esmeralda Road (*see* Plate 1) the tin is found either in a lode formation or in alluvial deposits, and the area of the whole field, so far as recent discoveries have indicated, is about one hundred square miles.

GEOLOGICAL FORMATIONS.

In travelling from Croydon to Stanhills, granite is first seen at Moonlight Creek, and is observed to continue through a defile known as the Bucket Gap, where it is covered on either side with thick beds of Desert Sandstone. From the gap the granite extends all along the route to the tinfields, but with numerous alternations of masses of quartz-felsite, aplite, and chlorite.

The Desert Sandstone forms isolated flat-topped hills in the granite country, and are conspicuous features in every part of the tinfield. At the Black Springs, about a mile from the Esmeralda Road (*see* Plate 1) it is, itself, tin-bearing in places, as well as forming a capping to tin-bearing granite.

At Pharaoh's Falls, on Nundah Creek (*see* Plates 4 and 5), the sandstones form the lower edges of a horizontally-bedded series, resting on granite and quartz-felsite at the base of the Gregory Range. There are here several interesting geological sections exposed in the cliffs, and after a spell of dry weather, when all sediment adhering to the rocks are removed, the cliffs are seen to be fantastically marked with red-and-white colouring, and the Egyptian appearance produced by these markings has suggested the name given to the Falls.

The rocks are tuffaceous sandstones, and were originally of a uniform reddish colour, but along the joint planes the colouring matter has been leached out by water, leaving the rocks white in the vicinity of the joints, and reddish some few inches away.

MINES.

The principal lode-tin deposit is that at the *Brilliant P.C. Mine*, the position of which is shown on the accompanying plans (Plates 1 and 2). The country in this locality is composed of altered granite(?), aplite, and quartz-felsite, the tinstone being distributed irregularly through chlorite mixed with quartz and greisen. No definite trend of the ore-body up to the present has been distinguished, although surface and underground indications show a general east-and-west strike.

The minerals associated with the tinstone are copper and iron pyrites, galena, and zinc blende, the copper pyrites occurring only in traces, the other minerals to the extent of a few per cent.

The workings are situated near the centre of the lease, and consist of two shafts and two cross-cuts. No. 1 Shaft is over fifty feet deep, but, being filled up to that level with mullock, the actual depth could not be determined at the time of the examination. No. 2 Shaft is also fifty feet deep, from the bottom of which a cross-cut connects it with No. 1 Shaft. From No. 1 Shaft this cross-cut was driven a distance of fifteen feet, in the direction E.N.E., and was then turned northerly to meet No. 2 Shaft. The second cross-cut has been driven E.N.E. from No. 1 Shaft at a depth of thirty feet from the surface, the length being twenty feet.

Some of the stone taken from the lode is exceedingly rich, and several tons of thirty-per-cent. ore at the time of the inspection was stacked on the surface. The portion of the unbroken lode, as exposed in the workings, contains up to one per cent. of tin, mixed in places with zinc blende and iron pyrites, but at the bottom of No. 1 Shaft the lode, while poor, gives promise of developing into the same class of rich stone that was found in the shaft nearer the surface.

Trenches have been made around No. 1 Shaft, and have exposed some large specimens of rich ore, but the other portions of the lode, exposed in the same workings, show only traces of tin.

There is every probability of rich and poor bodies of ore alternating with one another, although at present no order can be seen as to how these bodies occur. It is impossible, therefore, to state definitely in what direction operations should be extended, except to advise that the ore be followed along its probably east-and-west course, and to be prepared to find very rich bunches of ore in very poor country.

About ten chains to the north-east of the above main workings, a trench seventy feet long has been made in a tin-bearing aplite dyke contained in altered granite country. A flat deposit of tin ore, about two feet thick, was discovered in one part of the trench, and the mineral therein shown indicates that further work should be expended upon it. A smaller vein of similar quality stone, about two inches thick, is also exposed in the trench.

The position of these workings is shown on Plate 2, and the battery returns from the crushed ore are given in a table further on.

The old claim, *Brilliant No. 1*, is situated to the east of the Brilliant P.C. Mine, the workings consisting simply of a trench in which a vein of rich tin ore has been exposed. The country is granite and felsite, the lode being composed of chlorite and aplite, but the vein of ore in the trench pinched out after being followed for a few feet.

The *Ivanhoe Mine*, now included in the Brilliant North Lease, is located about eighteen chains to the north of the Brilliant P.C. workings. A shaft has been sunk to a depth of forty feet, in both coarse and fine-grained granite, quartz-felsite, and chlorite; the tin ore, it is said, showing in small veins in the granite and chlorite. At a depth of sixteen feet from the surface the veins have been cut off horizontally, and further sinking did not result in anything being discovered. Stone raised from this shaft amounted to several tons, having an estimated yield of about four per cent. of tin, and containing traces of galena.

In the bed of the creek, close to the shaft, a chlorite lode containing a quartz vein is exposed between granite and felsite walls, both the chlorite and quartz being tin-bearing. The lode has not been prospected, although it can be traced along the surface for about eighty feet, and no idea could be gained of its character or value. It appears to be very rich, however, being studded with tin crystals (cassiterite) in places, and as it may have some connection with the lode worked in the shaft, it certainly should not be neglected when prospecting operations are taken in hand.

The position of the Ivanhoe workings is shown on Plate 2.

The New Chum Mine, also included in the Brilliant North Lease, lies ten chains south-west of the Ivanhoe, and fifteen chains west of the Brilliant P.C. Shafts (*see* Plan 2), the workings consisting of some excavations and a shaft in chlorite and felsite, with granite on either side. The latter rock is alternately fine and coarse in texture, and appears to be in the form of dykes in felsite, the tin occurring as small but rich veins and irregular masses throughout the formation. The felsite contains rounded blebs of graphite, and a decomposed granite in the vicinity contains vermiculite mica.

A few yards westerly from the excavations a shaft has been sunk to a depth of twenty-eight feet, the lode here being made up of chlorite and quartzite, and associated with felsite and granite. The tin taken out is said to have occurred as small rich veins.

The Koh-i-nor Mine lies on the top of a ridge about a mile to the north-east of the Brilliant P.C. Mines. The country is quartz-felsite, and the tin occurs in a quartz vein, varying in thickness from five inches down to a mere thread, a vein of almost pure tinstone, two inches thick, being exposed in the workings. Two shafts have been sunk, each to a depth of about forty feet, and about sixty feet apart, and a trench twenty feet long has also been excavated, but the ore body exposed in these workings gradually becomes smaller, and as it is followed down it pinches out altogether.

On the road to the Springs, a few chains easterly from the Koh-i-nor, a chlorite lode has been prospected, and several tons of stone from here is said to have yielded nine per cent. of clean ore by crushing and concentration.

Furbur and White's Homestead Claim is situated about a mile northerly from the Koh-i-nor, and is surrounded by hills capped with "Desert Sandstone." On this property a chlorite lode has been exposed for some distance, and the prospecting work carried out on it, although very limited, has been sufficient to indicate that it has an east-and-west trend, and is several feet wide. The chlorite is associated with aplite, neither granite nor felsite being found close to the workings, although present in the vicinity.

The yields of tin from the ore is said to average 3½ per cent., but the value of the deposit, as a whole, has not yet been determined.

The Miner's Punch workings, now idle, are located on the northern side of the Ten-mile Creek, and are about three-quarters of a mile north-westerly from the Ivanhoe Shaft, and about a mile slightly north of this direction from the Brilliant P.C. Shafts. The country rocks are tourmaline-bearing granite and quartz-felsite, the former carrying a tin-bearing lode almost in contact with the latter. The trend of the lode is north and south, and this has been well shown in the trenches which have been made. The tinstone is contained in chlorite and quartzite, but although several tons of nine per cent. ore is stated to have been taken from the lode exposed in the workings, the mere traces of tin which now remain do not offer much encouragement to carry on further prospecting work.

The Comet Mines are on the north side of the Ten-mile Creek, close to the Esmeralda Road, and, in a direct line, are about two miles north-west from the Brilliant P.C. Mines (*see* Plates 1 and 2). The country for the most part is coarse-grained granite, this rock changing to a fine-grained granite and a dark-coloured quartzite, all being in close association with a pipe-like mass of chlorite and with irregular bunches and small veins of quartz.

In the chlorite a shaft has been sunk to a depth of about sixty-five feet, exposing bodies of ore made up of tinstone, galena, zinc blende, and copper pyrites, with copper carbonates near the surface. All of these minerals are in the chlorite, although most of the tinstone occurs quite free from the other minerals. The quantity of ore taken from the shaft is said to amount to 233 tons, as shown in the battery returns on page 12, the yields from which amounted from five to ten per cent. of tin. Some of this stone, however, may have been taken from other mines in the neighbourhood and included in the Comet returns, but the quantity from this source would not amount to many tons.

About 400 feet north from the Comet Mine, a sixteen-foot shaft has been sunk in chlorite, the general conditions being somewhat similar to those prevailing at that mine, except that the chlorite lode is associated with a quartz blow. No yields of tin are reported from this mine.

To the south of the Comet shaft a chlorite lode, three feet thick, is exposed within granite walls, this rock merging into aplite and pegmatite. Tin ore has been removed from the outcrop of this lode.

The Douglas Mine is located on the Ten-mile Creek, about five miles westerly from the Comet, and about the same distance south of Flanagan's Homestead Lease (*see* Plate 1). The country rocks are granite and greisen, in which there exists a four-foot lode of tin-bearing chlorite, having approximately an east-and-west strike, and exposed for a distance of about one hundred yards. A shaft has been sunk on the lode to a depth of fifty feet, but no information could be gleaned concerning it, further than that several tons of good ore were taken away and that the mine was grossly mismanaged.

Kellaway's Claim is about a quarter of a mile north of the Douglas Mine (*see* Plate 1). The lode is made up of chlorite and greisen, has an east-and-west strike, is about four feet wide, and is contained between granite walls. Six inches of the lode is said to be rich, but no authentic information is obtainable.

Foley's Mine lies about one and a-half miles west of the Comet Mines, and about the same distance south from the junction of Rocky Creek and Ten-mile Creek. There are two tin-bearing formations present in the workings, each thirty feet wide, and they are in felsite. No information is available concerning the results of prospecting operations.

Wheeler's Claim is situated about five miles to the south of the Comet Mines (*see* Plate 1). A lode of irregular shape, and consisting of chlorite, quartz, and greisen is exposed between granite and quartz-felsite, and has been worked in an open-cut to a depth of about ten feet. Seven tons of stone has been removed from the lode, and is said to have given a return of eight per cent. of tin.

Flanagan's Claim is located on Mistake Creek, less than a mile west of the crossing of the Esmeralda Road. The country is granite, with occasional outcrops of quartz-felsite and greisen. The tinstone occurs irregularly in the greisen, both quartz and chlorite being absent. The prospecting work consists of some shallow excavations in the greisen, but is not sufficient to prove the extent or character of the deposit.

There is a large area of tin-bearing country exposed in this locality, which might carry sufficient tin to make portions of it a low-grade proposition. In view of this possibility, it might be advisable to prospect the tin-bearing outcrops in the neighbourhood, and also those to the north-west towards Furbur and White's Claim, the latter probably being part of one long continuous belt extending to Flanagan's Mine.

Other localities have been reported to contain tin-bearing lodes, one in particular being about fifteen miles west of the Brilliant Mines. If this information be correct, the area of the Stanhills tinfield would be considerably extended. Another locality mentioned is about eight miles northerly from the mill on Lease 2051 (*see* Plate 1), and Mr. C. F. Valentine reported it to be " a chloritic outcrop which has fairly big possibilities." It is said to consist of two formations, each made up of quartz and chlorite, the larger of which is ten feet wide.

ALLUVIAL DEPOSITS.

Very little stream tin had been found up to the time of the inspection of the tinfield by the writer, but recently some very rich patches of washdirt have been discovered near the Brilliant Group of mines, and attention has in consequence been drawn to the general occurrence of the tin in the alluvial deposits throughout the district.

On the branch of *Ten-mile Creek*, between the Miner's Punch and Furbur's Old Homestead Claim, there is an alluvial formation of about half a mile square in area, which may contain deposits of stream tin, while there are hosts of other localities about the heads of the Ten-mile Creek and other watercourses in this direction which might also be found ultimately to be tin-bearing, each, perhaps, limited in extent, but probably rich.

At the locality called the *Black Springs Waterhole*, on Locket Creek, situated about one and a-half miles east of Flanagan's Homestead Lease (*see* Plate 1) there are shallow alluvial deposits containing tin and gold, but there has not been sufficient development to prove their extent, or to show their connection with the beds of "Desert Sandstone" which form the ridges to the west of the waterhole, and which are themselves tin-bearing. The surface deposits here are undoubtedly rich in places, and in the wet seasons have been worked very profitably both for tin and gold—principally the latter—and they certainly deserve further attention. The "Desert Sandstone" comprises hard beds of tin-bearing sandstone, several feet thick, but it has not been prospected, and its possibilities are yet unknown.

If the area of tin and gold-bearing country were proved to be extensive, and warranted developments on a large scale, water could be conserved in dams, or could be supplied by pumping from the permanent supply at the Black Butt Springs, about one and a-half miles south of the Black Springs Waterhole.

At the *Alluvial Springs*, about five miles to the north-west of the Black Springs, and about three miles from the Bucket Gap (*see* Plate 1), an alluvial deposit of tin was discovered many years ago in the "Desert Sandstone," but, after being prospected and tested, the yields of tin obtained were not then considered satisfactory, and the mine was abandoned.

PROSPECTS OF THE FIELD.

At the time of the inspection the Brilliant P.C. Mine was being developed, and some very rich ore had just been taken from the workings. Since then the Brilliant Mine has continued to produce high-grade stone near the surface, whilst in the watercourses in the neighbourhood, and at some distance away, many tons of stream tin have recently been found (*see* Plates 1 and 2).

A large number of men are now working the alluvial deposits, and no doubt employment will be found for the miners for some time to come. Very rich patches of washdirt are bound to be found in the gullies, but, with the absence of extensive alluvial deposits (the contour of the country being adverse to the formation of deep leads), there is hardly any probability of the field becoming an alluvial one of any great importance. On the other hand, the tin-lodes deserve attention, and amongst the number which have only been cursorily tried there are some which, on development, might prove to be of great extent and richness.

STANHILLS TIN RETURNS.

—	Tin Ore.				Black Tin.				Value.		
	T.	C.	Q.	LB.	T.	C.	Q.	LB.	£	s.	d.
BRILLIANT P.C. LEASE.											
1900—Sent to Sydney (Dapto) ...	3	1	3	14	1	7	2	3	99	12	6
1900—Sent to Sydney (Dapto) ...	3	12	1	25	1	3	0	21	92	9	2
1902—Sent to Sydney (Dapto) ...	1	10	1	8	0	11	3	25	37	2	6
1904—Treated at Rocky Mill ...	78	0	0	0	4	5	0	14	229	16	9
1905—Sent to Sydney (Dapto) ...	2	16	0	9	0	18	3	21	81	0	0
Total	89	0	3	0	8	6	3	0	£540	0	11
COMET LEASE.											
1900—Sent to Sydney (Dapto) ...	3	4	1	12	0	14	2	17	57	19	8
1901—Sent to Sydney (Dapto) ...	30	0	0	0	3	5	0	0	126	10	0
1902—Crushed at Rocky Mill ...	50	0	0	0	5	0	0	0	250	0	0
1903—Crushed at Rocky Mill ...	10	0	0	0	1	0	0	0	50	0	0
1904—Crushed at Rocky Mill ...	80	0	0	0	6	10	0	0	377	0	0
1904—Crushed at Rocky Mill (seconds)	60	0	0	0	2	4	0	0	118	16	0
Total	233	4	1	12	18	13	2	17	£980	5	8

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PLATE 1.

SKETCH PLAN (UNSURVEYED) OF STANHILLS TINFIELDS.

The information contained on this plan has been compiled from several sources, but mostly from data supplied by Mr. Charles Furbur, who, as a prospector, has become thoroughly acquainted with this part of the country.

The topographical features have not been surveyed, so that the position of the creeks, lagoons, springs, &c., are given very roughly. Except the Comet and Brilliant Mines, which have been surveyed, the positions of all the tin-mining centres are also given approximately.

PLATE I.

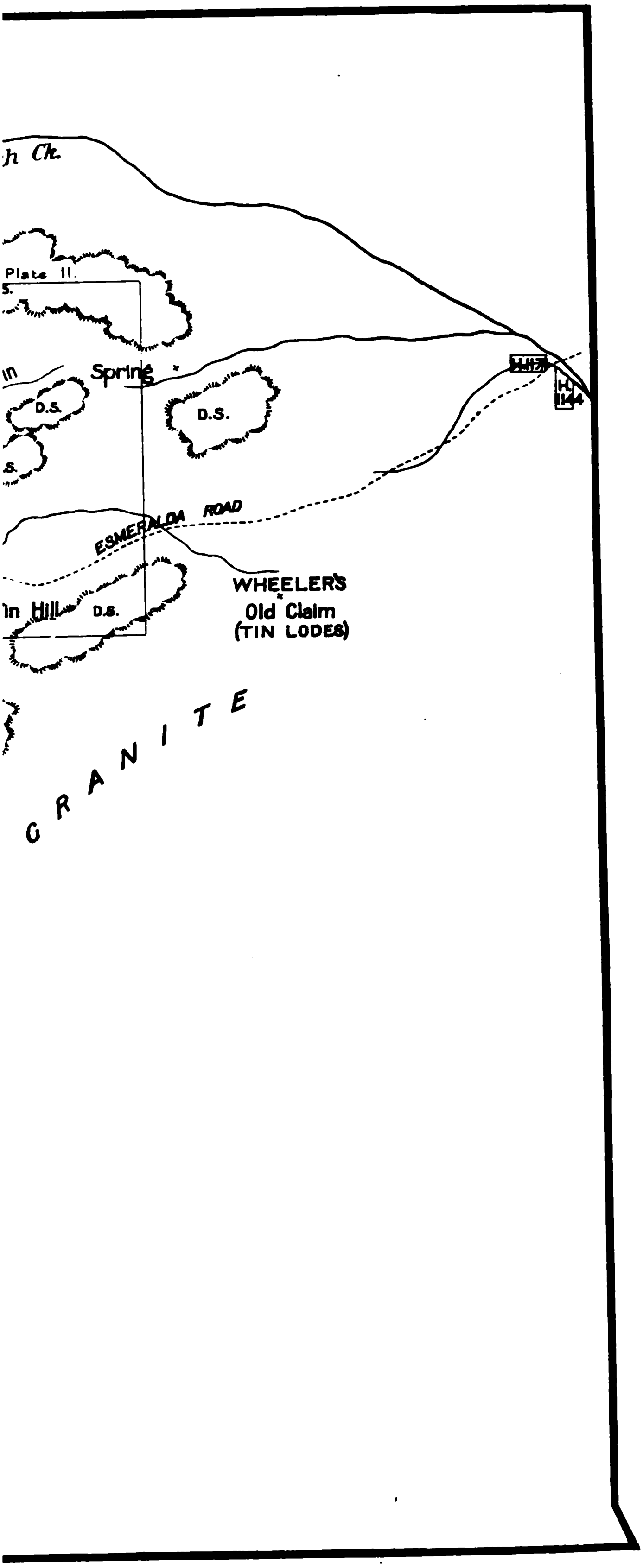

h Ch.
Plate II.
S.
in
Spring
D.S.
D.S.
S.
H.1117
H.
1144
ESMERALDA ROAD
WHEELER'S
Old Claim
(TIN LODES)
in Hill
D.S.
GRANITE

PLATE 2.

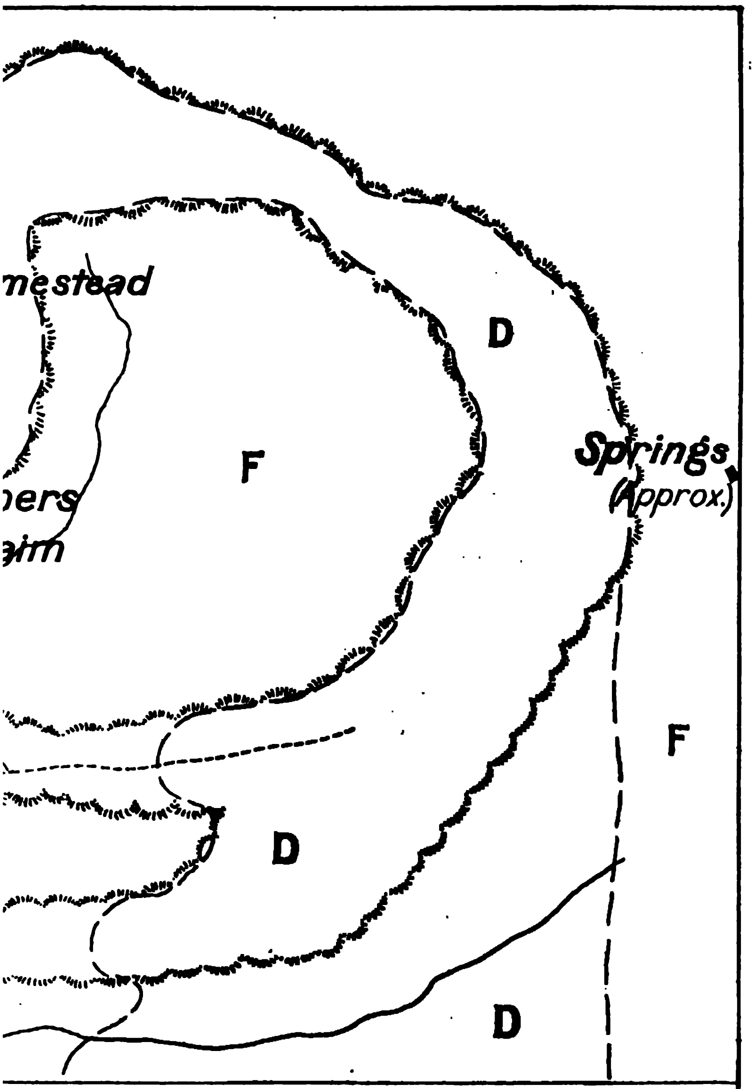
GEOGRAPHICAL SKETCH PLAN OF PORTION OF THE STANHILLS TINFIELDS.

The work of accumulating the information for this plan was carried out very rapidly, so that the geological features shown are only approximately correct.

The alluvium, as a deposit of any extent, is only seen in one locality, but there are many other places where tin deposits exist in small areas, which, however, are often very richly tin-bearing.

The "Desert Sandstone" forms the caps of most of the granite hills around the tinfields, and is sometimes tin-bearing. They are evidently formed from tin-bearing granites, which once existed at higher levels, but which have since then been worn down to their present level.

The Quartz Felsite and Granite occur irregularly associated with one another, changing gradually into one another and into greisen. The contact between the two former rocks in the vicinity of the Brilliant Mines is not defined, and the geological lines are here subject to revision.



GEOLOGICAL SKETCH MAP
of portion of the
STANHILLS TINFIELD
NEAR CROYDON
Accompanying Report
BY
B. DUNSTAN, F. G. S.
Acting Government Geologist
1907.

Scale 46 Chains to an Inch
46 23 0 46 92

Drawn at the Geological Survey Office, Brisbane, Queensland.

PLATE 3.

PHOTOGRAPH OF THE BRILLIANT P.C. TIN MINE, STANHILLS TINFIELDS.

The blocks of stone in the foreground are very rich tin ore, a specimen in the Geological Museum from this mine assaying 34 per cent. of tin, and weighing one and a-half hundredweights.

The excavations shown in the view have been sunk for the purpose of following the rich body of ore traced along the surface by Mr. C. Furbur, but since the photograph was taken this work has been much extended. Some large slugs of pure tin ore were found on the surface, to the left of the view, and this led to the prospecting work which revealed the tin-ore *in situ*.

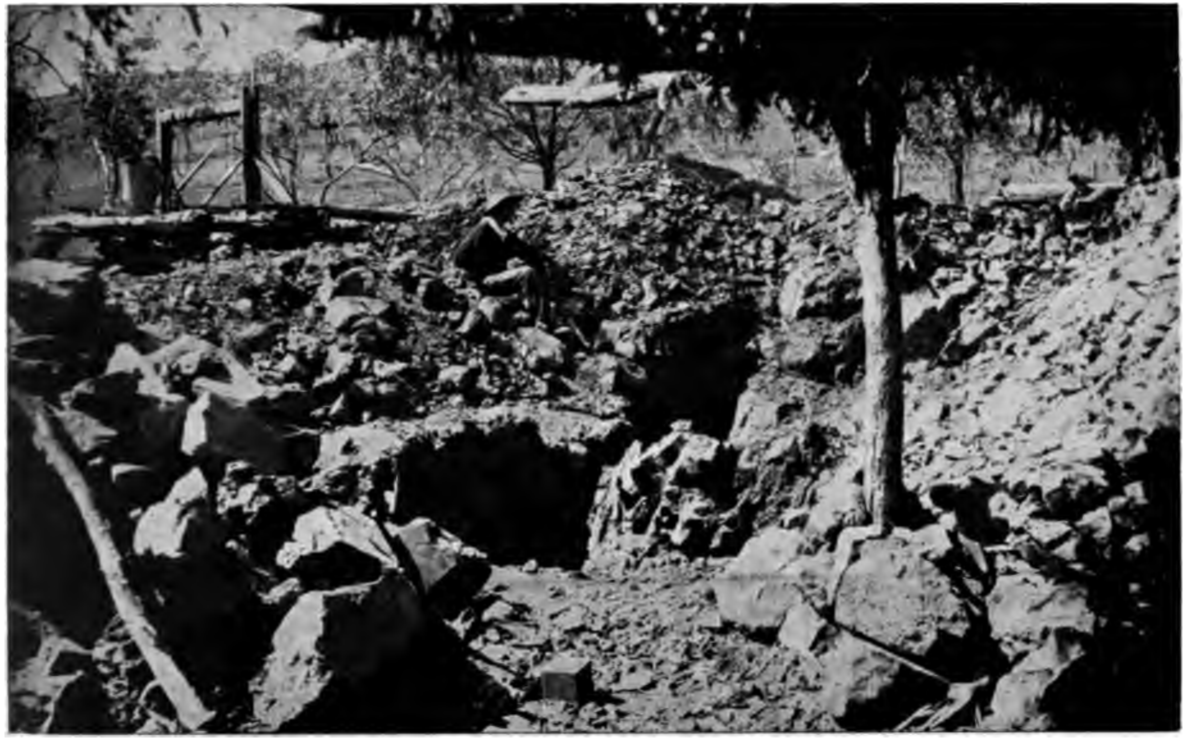


PLATE 3.—BRILLIANT P.C. TIN MINE, STANHILLS TINFIELD.

PLATE 4.

PHOTOGRAPH OF PHARAOH'S FALLS, NUNDAH CREEK, STANHILLS.

The cliffs are composed of beds of "Desert Sandstone," with an underlying stratum of clay. The weathering out of this clay, by atmospheric agencies, combined with the vertical joints in the rocks, cause the breaking down of the beds, and thus the formation of the cliffs.

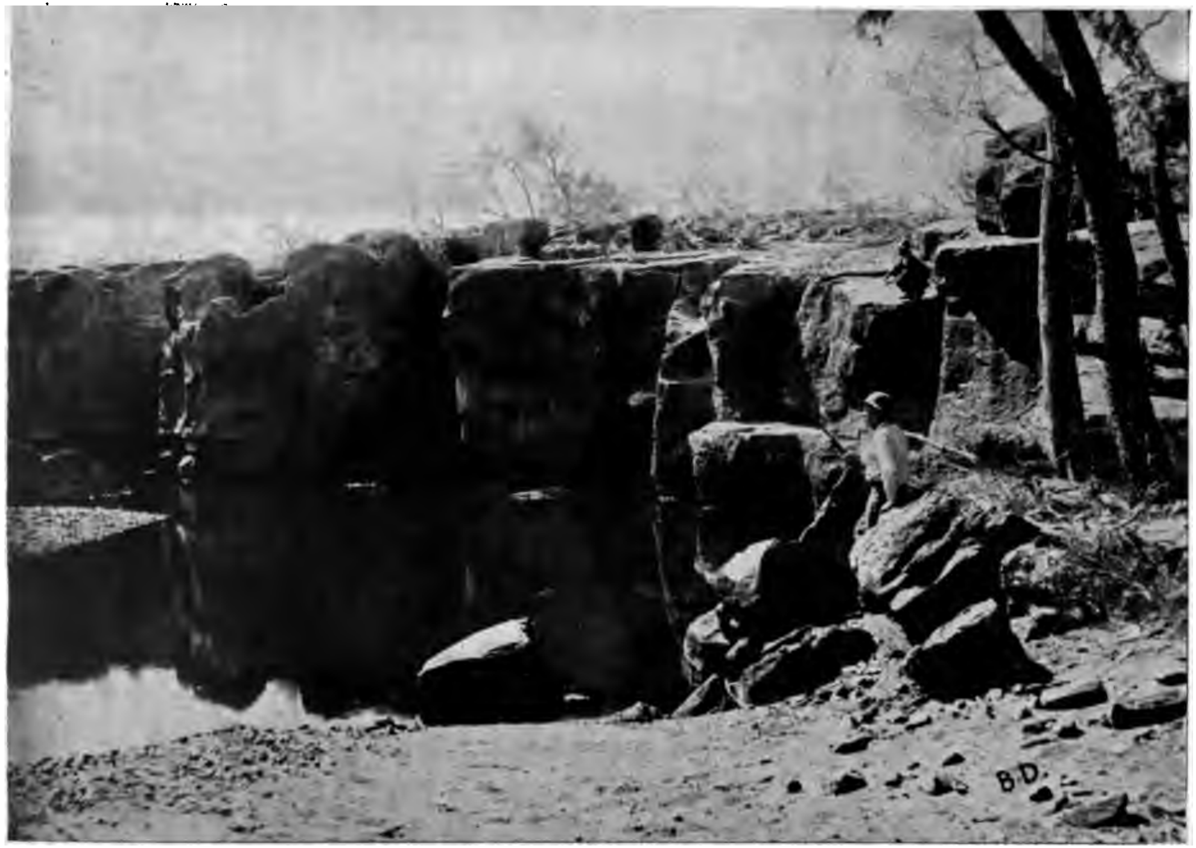


PLATE 4.—PHARAOH'S FALLS, NUNDAH CREEK, STANHILLS.

PLATE 5.

PHOTOGRAPH OF PHARAOH'S FALLS, SHOWING CLEOPATRA'S BASIN.

The two large blocks of stone in the centre of the view have been broken down from the bed on the left side by the action of flood water. The dark pool at the back of the displaced block is called "Cleopatra's" basin, and the water coming into this from the fluted channel above during a storm makes a sound which can be heard for miles.

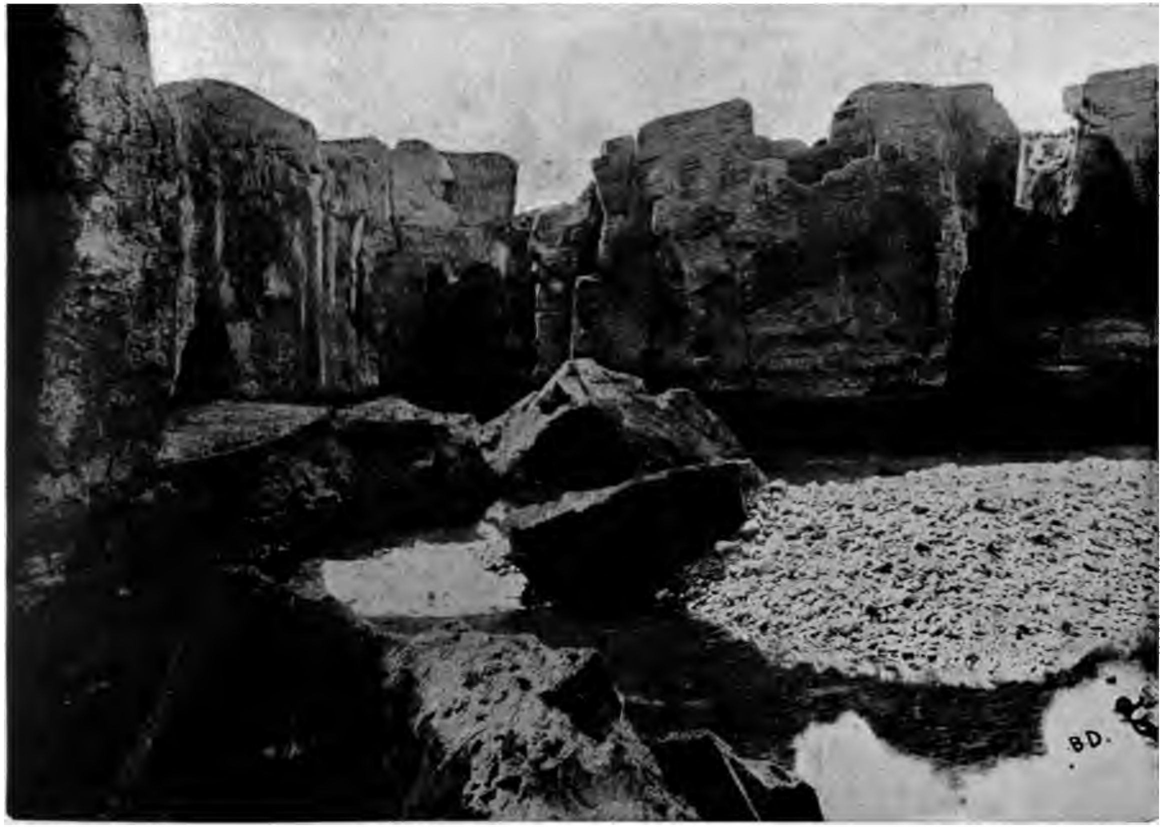


Plate 5.—Pharaoh's Falls. View showing Cleopatra's Basin.

J C Brunnich

Queensland.

DEPARTMENT OF MINES.

Queensland Geological Survey.

(B. DUNSTAN, ACTING GOVERNMENT GEOLOGIST.)

PUBLICATION No. 213.

SOME

CROYDON GOLD MINES

(Part 2),

WITH SPECIAL REFERENCE TO BENNION'S REEF AND
THE HIGHLAND MARY REEF.

[WITH TEN PLATES.]

By B. DUNSTAN, F.G.S.;
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SOME CROYDON GOLD MINES.

With Special Reference to Bennion's Reef and the Highland Mary Reef.

INTRODUCTION.

The Highland Mary Reef, close to the town of Croydon, produced some very rich yields of gold many years ago, and on account of the recent failure in the prospecting developments in many of the mines at Croydon causing a general depression in the local mining industry, some attention has lately been given to this once important line of reef, with a view of having it reopened and worked again.

A visit was paid to Croydon in July, 1906, for the purpose of obtaining data bearing on the old workings of the above reef, and also to inspect the recent developments in Bennion's Mine. A reef has been found in the latter mine which, it is thought, might have some connection with the Lady Mary and other reefs that once yielded a large amount of gold close to the surface.

THE HIGHLAND MARY REEF.

The accompanying sketch plan (Plate 2) shows the position of the two sites on the Highland Mary reef, where it has been suggested operations should be commenced, the site marked " A " being that of the proposed deep shaft, 600 ft. away from the outcrop; the other, marked " B," being the site of a shaft already sunk, where it is thought a reef exists which might be worked on the underlie.

After examining the surface features about the outcrop of the Highland Mary Reef, and noting all the information which has been accumulated bearing on the past history of the mining developments in this locality, one comes to the opinion that the sinking of the " A" shaft, 600 yards away from the outcrop, is far too hazardous to warrant the expenditure of money on it until some further developments have taken place nearer the outcrop.

The other proposition, to sink an underlie shaft, " B," from the No. 1 South Block shaft, required some consideration, as the shaft is said to be sunk to a well-defined reef. Some of the old miners, however, are of the opinion that in these workings the only reef existing is a vertical one quite distinct from the Highland Mary, and Mr. J. Bickerton, who claims to have been the last man to work in this mine, states positively that there is no reef down in the underlie at the bottom of the straight shaft. Since examining the field the departmental records of the three bores which were sunk on the Highland Mary reef during the years 1890 and 1891 have been examined, and these throw some further light on the subject.

The bore known as No. 1 is situated on the Highland Mary No. 1 South Block, and is marked "C" on the accompanying plan. It was started on the 2nd July, 1890 (Foreman Elliott in charge), and after boring to a depth of 490 feet, the rods broke, and work, on 17th January, 1891, was discontinued. At 182 feet, crushed granite was passed through; and at 243 feet blue granite, containing graphite, was met with. At 368 feet, two veins of quartz occur, each one quarter of an inch thick; and, at 371 feet, several vertical quartz leaders were passed through, varying in thickness up to one quarter of an inch, and contained in hard blue granite. In this bore there is nothing to indicate that the reef was passed through, although it is quite possible that the reef may be present, and that the bore has passed through a "blank" without showing any indication of its presence. (These blank areas are common in the Golden Gate Reef.)

No. 2 bore, marked "D" on Plate 2, is situated on the Highland Mary No. 1 Block Claim, and was started on 7th February, 1891, reaching a depth of 267 feet on the 16th May of the same year. At 204 feet hard but broken "spar" was passed through, and at 219 feet granite containing graphite was met with, 13 feet of this being penetrated, and at the bottom graphite also occurred in a grey granite. This bore also was disappointing, and gave no signs of a reef further than what the "spar" at 204 feet and the graphite at 219 feet might indicate.

No. 3 bore was sunk close to the Glengarry Mine, marked "E" on Plate 2, and started operations on the 15th June, 1891. A depth of 266 feet was reached, and the work ceased on the 17th October, 1891. At a depth of 72 feet a hard slaty rock was passed through, more of the same material being met with at 92 feet. At 93 feet a band of broken rock was encountered, and at 102 feet a rock, described as "red conglomerate," was passed through, this formation being over 10 feet thick. At 103 feet a band of serpentinous rock was struck, but below this nothing but hard granite was found, except plumbago in blue granite at 266 feet, where the boring operations stopped.

The information from these bores goes to show that the reef has not been found at the depth expected, and confirms Mr. Bickerton's positive assertion that there is no reef which could possibly be the Highland Mary Reef in the workings of the No. 1 South Block Shaft.

Mr. Rands, who made a report on the Croydon Goldfield, states that the bores "were all sunk in hard intrusive granite," and were put down too close to the line on which the reef was lost. Had they been put down in the metamorphic granite, further to the north-east, the Highland Mary Reef would most probably have been discovered."*

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* The Croydon Goldfield. W.H.R. Fcp. (C.A. Paper). By Auth., Bris., 1896. [With 5 maps and 11 plates.] (G.S.Q.P., No. 118.)

To the west of No. 3 bore, in the Glengarry workings, according to Mr. Rands, a break or fault exists, and where the bore reached the depth at which the reef should have been found—that is, at about 200 ft.—no indication of a reef was to be seen; so evidently there is a break, or fault, between the bottom of the Glengarry workings and No. 3 bore.

At the bottom of No. 3 bore (266 feet), and at a depth of 219 feet in No. 1 bore, granite containing graphite was found, and with the evident westerly dip of the hard granite which has cut off the reef in some of the workings, possibly this graphitic granite underlies, with a westerly dip, this hard granite. If this be so, then the conditions would be more favourable for prospecting to the east of the line of the three bores and the No. 1 South Block Shaft.

During the examination of the field the granite taken out of the Highland Mary Extended Block Shaft, marked "F" on accompanying plan, was inspected, and the conclusion drawn therefrom indicated that it has been sunk in graphitic granite, or what Mr. Rands has referred to as metamorphic granite, and that in consequence operations should begin in this shaft, and not the No. 1 South Block Shaft.

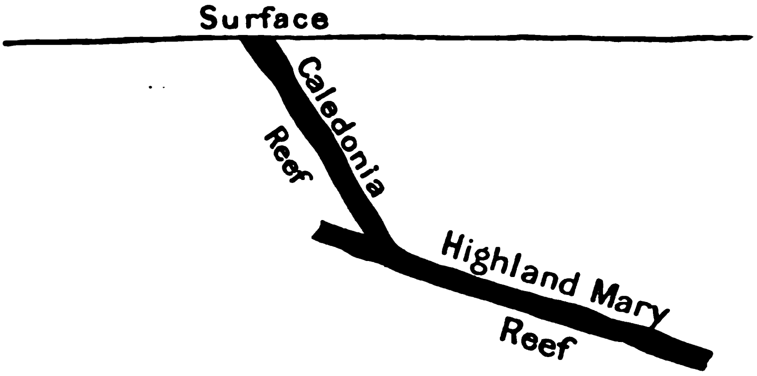
The sinking of a shaft at the position marked "A" has been estimated to cost £20,000, providing for a probable influx of water and other contingencies; while the cost of renovating the Highland Mary Extended Block Shaft, marked "F" on the plan, would not be more than £5,000. The latter position being found to be much more suitable when considered from all points of view, and the cost of sinking the shaft, both to the company and to the Department which has promised to subsidise it £1 for £1, being so much less than the first one selected, a recommendation was made to have it reopened and tested, in preference to sinking the "A" shaft and the reopening of the shaft at "B." This being considered satisfactory to all concerned, the work of forming the company, under the title of the "Highland Mary Blocks, Limited," was at once taken in hand, and the repairing and cleaning out of the shaft, prior to development, is now in progress.

It has been difficult to obtain any reliable data concerning the Highland Mary workings, but the information shown on the accompanying plans and sections (Plates 1 to 5) is fairly accurate, so far as it goes. A study of these will throw some light on the work performed in the past, and will also bear on that which has recently been taken in hand.

Some statements have been made by miners who at one time worked in the Highland Mary mines, and it is advisable that a record be kept of those which refer to the underground workings, so that in any work contemplated they may be brought into consideration. These are as follows:—

1. It is stated that the easterly dip of the Highland Mary Reef is flat near the Caledonia, but that where the reef turns and dips southerly the inclination becomes very steep, thus forming that portion known as the Caledonia. The severity of the movement which produced the bending also caused the reef to break and slide, one portion being thrust under the other, the upper steep portions being the Caledonia, the lower being the Highland Mary, as shown in Fig. 1.

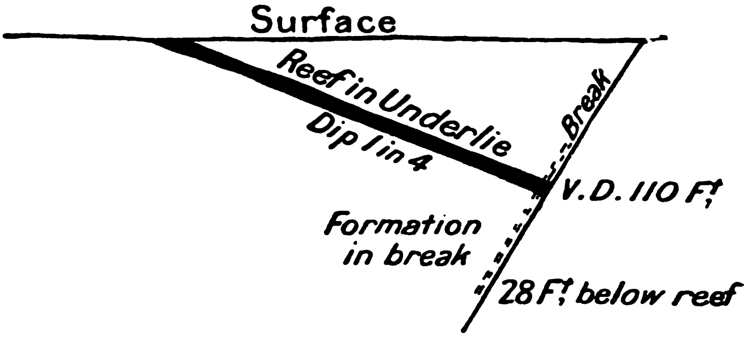
FIG. 1.



SECTION ACROSS THE HIGHLAND MARY LINE OF REEF.
Showing a thrust movement.

2. In the No. 1 North P.C. Highland Mary underlie the reef, according to the late Mr. H. Rouse, dips 1 in 4 easterly, until it reaches a vertical depth of 110 feet, where a steep fault or break, having a westerly dip, was encountered. In this break a formation was found, and was followed down under the reef to a depth of 28 feet, where the work was abandoned. This is shown in Fig. 2.

FIG. 2.



SECTION ACROSS THE HIGHLAND MARY REEF.
Showing a formation on the face of the hard granite bar.

3. Mr. Rouse also stated that there is no defined break in the No. 1 P.C. Underlie, but a formation exists without a reef, and at the bottom the hanging wall turned steeply over.

4. A vertical reef is supposed to exist about 300 feet in front (*i.e.*, to the east of the outcrop) of the main line of reef, and it has been suggested that this vertical reef is on a line of fault, corresponding with the break shown in Fig. 2.

5. In the Highland Mary No. 1 Block Shaft (*i.e.*, No. 1 and 2 United Blocks) a reef is said to exist at a depth of 300 feet from the surface, but the prospects at the time of sinking were not satisfactory, and a reef previously passed through at 180 feet was opened up. From this top reef two crushings were taken, yielding respectively 36 dwt. and 33 dwt. of gold to the ton.

6. The Glengarry Reef, so Mr. S. Murdock states, has *never* been lost, but has split up into numerous leaders, which he anticipates will come together lower down.

The returns of gold given further on are from all the mines along the Highland Mary Line, and one prominent feature that may be pointed out in connection with these yields is that the whole of the gold which has an aggregate value of £241,167 has been obtained close to the surface, and within a little less than half a mile along its course.

REEFS ADJACENT TO BENNION'S MINE.

Sovereign and Post Hole Reef.—The principal workings on this reef are those in the shaft known as "Sandy Brown's Sovereign and Post Hole Subsidy Shaft," which has been sunk to a depth of 366 feet. The reefs are not well defined, are said to merge into one another, and are considered portions of the main Iguana Reef.

In the above-mentioned shaft a reef was found at about ninety feet from the surface, and below this a series of small leaders occur in a dark, fine-grained hornblendic granite, locally termed "diorite." The reef at ninety feet was worked in a level driven northerly for sixteen feet, but was cut off by a nearly vertical fault, and has not since been found.

In Sircom Street the Sovereign Reef is supposed to overlie the Post Hole Reef, but from the information supplied by the miners who were working in the reefs here some years ago, it would appear that the Post Hole Reef is only an upper portion of the Sovereign Reef, faulted on a slide which dips in a direction the reverse to the dip of the reef, and having a section somewhat like that shown diagrammatically in Fig. 3.

The positions of the reefs are shown on Plate 6, and the returns showing the yields of gold from the stone crushed are given on page 15.

Just-in-Time Reef.—This reef seems at one time to have been a portion of the Sovereign Reef, although now the distance between the two is considerable. In Sircom Street, and also at the junction of this and Brown Street, masses of quartz have been found, not connected in any way with a reef, but indicative of the disturbance of the rocks in the vicinity. The country here may have been disturbed before the reefs came into existence, but it is very probable that movements to form fissures and infiltration of quartz into the fissures to form reefs were going on simultaneously.

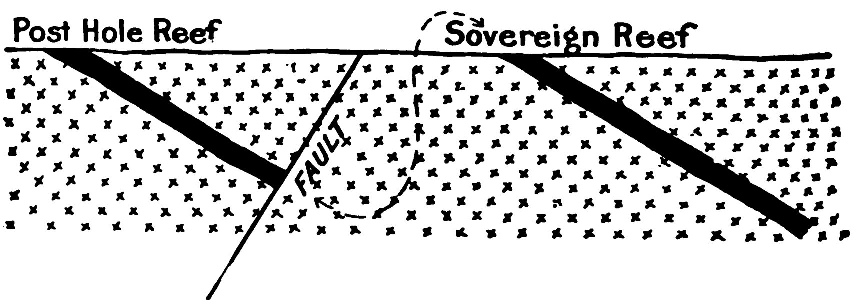
Apparently a large shear-plane, having a dip to the south, has cut off the upper portion of the Sovereign (Iguana) Reef, and that a movement took place to fault this upper portion down the dip of the shear-plane, and to form what is now known as the Post Hole Reef.

Subsequently the moved portion of the Sovereign Reef—*i.e.*, the Post Hole—has been broken by a vertical joint at right angles with the shear-plane, and a second movement, to the west of this vertical joint-plane, has shifted the reef, and the country with it, further to the south, leaving the Post Hole portion of the reef in the position which the first movement placed it. If these conditions be true, the Just-in-Time Reef would be the Sovereign Reef at its second movement, and, consequently, this line of reef would be of limited extent along its eastern trend, and would also pinch out or fault against the shear-plane when worked to the dip. Should such a movement dislocate any of the reefs in this neighbourhood, it would be necessary to rise up on the fault towards the surface to find their continuation, provided, of course, they have not been already exposed on the surface in this direction.

The workings of this reef have not been examined, but it is understood that they are not very extensive, neither were the returns very satisfactory when the mine was last worked.

The position of the Just-in-Time Reef is shown on Plate 6, and the tabulated returns of the stone crushed are given on page 15.

FIG 3



DIAGRAMMATIC SECTION ACROSS THE POST HOLE AND SOVEREIGN REEFS.

Showing the probable faulting of the Post Hole Reef from the top of the Sovereign Reef.

The *Sir Walter Reef* appears to be an eastern extension of the Just-in-Time Reef, from which it has been separated by a complexity of movements. The apparent fault on the vertical joint-plane in Sircom Street has caused a disturbance in the eastern continuation of the Just-in-Time, and the fault in Aldridge Street seems to have further added to the confusion.

Close to the hard granite bar, the Sir Walter is divided into two parallel reefs. The upper reef trends west-south-west, but turns sharply to the north-west at its south-easterly end, to trend parallel with the Sovereign, the other end of the reef coming up against the hard granite bar almost at right angles, and then turning around to join a leader lying parallel with the head.

Near the granite bar the lower reef is only separated from the upper one by a few inches, but as it trends to the south-west this distance increases until, where the top reef trends to the north-west, it continues on in the direction of the Just-in-Time.

The south-eastern face of the hard granite bar, at the north-eastern extremity of the Sir Walter Reef, has a dip to the south-west, and, as shown on the plan, comes in contact with the reef much further west where the workings have revealed it in the deeper levels. This is due to the reef dipping north-west, and the face of the bar dipping south-west.

The rocks about the reef are granites, more or less decomposed, but always containing graphite, which on the Croydon field is ever considered a gold indicator. The surface features of the Sir Walter Reef are shown on Plate 6, and in greater detail on Plate 7, its position with regard to the hard granite bar being shown on Plate 9.

The returns of gold from the workings on this reef are given further on.

The Lady Mary Reef.—The position and features of this reef are shown on Plate 6, and in greater detail on Plate 7. It has been worked extensively along the surface, and has proved very richly gold-bearing. The reef is well defined near the junction of Brown and McArthur Streets, its most south-easterly extremity, and has a distinct westerly dip, but changes rapidly a little further north-west to a basin-shaped deposit.

There is a large dyke mass close to the reef in McArthur Street (*see* Plate 7), which may have had some bearing on its irregular structure, and on its disappearance along a fault plane in the ground west of the outcrop. The reef rises to the surface further north, and on Block LXXIII., north of Brown Street, it became exposed as a horizontal sheet of quartz, all of which was found to be gold-bearing.

The belt of hard granite with which the Sir Walter Reef came in contact has disturbed the Lady Mary Reef, and there is a possibility that on the north-eastern side of this hard belt the Lady Mary would make again, and be found as a continuation of the small reef now being worked in Bennion's Mine, although a greater probability exists that it is another reef altogether.

The returns from the Lady Mary Reef are attached.

BENNION'S MINE AND REEF.

Operations started on this reef by a series of 23 bores being sunk in the north-eastern corner of Block LXVI. A well in the vicinity revealed a soft formation of graphitic granite about thirty feet from the surface, and the bores were put down to strike this formation at a greater depth. The bore records show, however, that the sinking was not deep enough, except in the last bore, to meet the formation, the obstacles in the way of deep sinking being the granite boulders occurring just below the surface.

The position in the well in which the formation occurs at a depth of thirty feet is represented in the section on Plate 9, the position of a similar formation met with in Bennion's shaft at eighty feet being also shown.

The outcrop of the hard belt of granite previously referred to is situated to the west of the mine, but there is evidence of another belt of granite occurring to the east of Bennion's Shaft, the Sir Walter and Lady Mary Reefs being to the west of the former bar, Bennion's workings lying between the two. (*See* Plates 7 and 9.) The soft formation found in Bennion's Well and Shaft lies between the two belts or bars of hard granite; whilst to the west of the first, or main bar, there is also a soft, decomposed graphitic granite, the country in which the Sir Walter and Lady Mary Reefs occur.

There is some probability of the two belts of soft granite once being continuous, but they are now broken, and have been faulted by a movement on the west side of the main bar, the fault being about parallel with the general strike of the Sovereign and Lady Mary Reefs. This fault seems to have thrown down the country on the west side of the bar, bringing the soft graphitic granite containing the Sir Walter and Lady Mary Reefs against the hard granite. The section on Plate 9 illustrates this view of the subject, but to establish it as a fact more evidence is required concerning the thickness of the soft granitic belt at Bennion's Mine, in comparison with the soft granite in the vicinity of the Sir Walter and adjacent reefs, and also some evidence showing the character of the rocks to the north-east about the Black Snake Reef, whether the hanging-wall country of the latter corresponds to the country to the east of the bar and whether the footwall country correspond to the country on the west of the bar. If these could be correlated, it would rather show that the faulted portion of the Lady Mary-Sovereign-Iguana Reef is the Black Snake line of Reef.

It has been previously stated that the Just-in-Time and Sir Walter Reefs are probably separate portions of the same reef, and that the Sovereign and Post Hole Reefs are related to the Just-in-Time. The

Sovereign in making a bend in its course (as shown on Plates 6 and 7) and connecting with the Lady Mary, probably crosses the line of the Sir Walter, and so produces some confusion in this locality. Bennion's Reef, when discovered on the eastern side of this belt, was at first thought to be a continuation of the Just-in-Time and Sir Walter Reefs, but subsequent investigations showed it to have the same course as the Lady Mary, and to have some resemblance to this reef in other respects.

The workings at Bennion's Mine consist of two shafts, a well, a level, and two crosscuts. No. 1 shaft has been sunk vertically to a depth of 194 feet, meeting the formation similar to that found in the well at 80 feet from the surface, and a reef at 155 feet. The underlie from this shaft was put down at 155 feet on the reef, which proved to be poor, about eight inches in thickness, and having an inclination of 1 in 3 to the south-east.

A level driven to the north-west exposed the reef for a distance of about thirty feet. A large formation accompanies the reef, but the reef itself contains two or three inches of payable gold-bearing stone.

Another level was driven from the shaft in a south-easterly direction, and, following the trend of the reef, was continued to the south-west, but no great variation in the size of the reef was observed, although the stone averaged in places between seven and eight ounces of gold to the ton. The level for the last eight feet was driven in footwall granite country, because the reef became very small, and because the appearance of the formation met with in driving was considered a favourable indication of the presence of a larger reef in the vicinity. A reef was not found, however, and a crosscut was then driven to connect the level with the No. 2 Shaft, some small, nearly vertical, quartz leaders being met with in the crosscut when making the connection.

No. 2 Shaft is situated about 150 feet in a southerly direction from No. 1 Shaft. No indication of a reef was found in sinking, and at 145 feet the work was discontinued, but later on the shaft was sunk to 160 feet, and a short crosscut at this depth, driven to the south-west in a large formation, met a reef eight inches thick. This is considered by some to be the same reef as that found in No. 1 Shaft, but as that (No. 1) reef becomes smaller in size as it trends to the south-east, probably it dies out altogether. On the other hand, the reef found in No. 2 Shaft, which cannot be connected with the first one on account of the failure to find it in the level and the long crosscut, is probably another reef altogether, which would most likely become smaller as it trends to the north-west, and larger as it trends in the opposite direction.

It is rather premature to make any observations on the behaviour of the reefs on this side of the main granite bar, but if the above conditions prevail, then we may expect the reefs to pinch out, or enlarge, within short distances, and that where one pinches out another is making in either the footwall or hanging-wall country.

The plan of these workings are shown on Plate 8, the general position of the reef with respect to other reefs in the vicinity being shown on Plate 7.,

It is proposed to further sink No. 2 Shaft, and subsequently to continue the work of development in the direction of the Lady Mary Reef, or rather where this reef would be found, if it exists, on the eastern side of the hard granite belt. The results of this development it will be impossible to forecast, but the remarkable yields of gold from this neighbourhood certainly warrant something being done to ascertain if the rich Lady Mary Reef continues over the bar into the deep ground. Should rich reefs be discovered, no doubt the whole of the mines along this wonderful line of reef—from Iguana Hill to the Highland Mary—will again be taken up as leases, and worked vigorously by mining companies.

THE GOVERNMENT BORE ON THE IGUANA REEF.

This bore was the fourth sunk by the Government to test the reefs in deep ground, and is located 1,300 feet from the outcrop of the Iguana Reef, the position being shown on Plate 6. Boring operations began on the 21st November, 1891, and were discontinued on the 18th December, 1893, the total depth bored being 532 feet. The object of boring was to meet the Iguana Reef, or the Chance Reef, which junctions with the Iguana; but the work proved a failure, as neither reef was found. The inclusion here of the record of the bore is desirable, in view of the contemplated development at Bennion's reef, on which it will probably have some bearing.

NO 4 BORE (ELLIOT'S).

	Surface.
Red gravel conglomerate	13·6
Red conglomerate with hard granite boulders	19·6
Hard grey granite, more or less jointy	26·0
Very hard grey granite[*]	57·6
Extremely hard grey granite	110·6
Hard grey granite, very jointy[†]	242·1
Yellowish and grey granite with quartz veins[‡]	275·9
Grey granite	288·9
Extremely hard grey granite	309·3
Yellowish-grey granite formation, with 9 inches quartz vein[‖]	405·0
Red granite	415·6
Extremely hard grey granite	443·9
Hard grey granite, very jointy	496·3
Extremely hard grey granite	504·3 to
Boring discontinued at	532·0

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[*] "Total cost of boring to this depth was about £2 15s. per foot."

[†] "Cost of boring between 102 and 264 feet was £2 11s. 7d. per foot."

[‡] "At a depth of 257 feet 10 inches, the extremely hard grey granite in which the drill has been boring almost from the surface was passed through, meeting with a very different kind of granite."

[‖] "At 405 feet the extremely hard granite gave place to a yellow granite formation with numerous small quartz veins or leaders, which continued to 412 feet 4 inches, when 3-inch vein of white quartz was pierced, dipping at an angle of 30 degrees from the horizontal, and passing into a yellow granite formation with quartz veins. Quartz tested, and found it to contain a large amount of iron pyrites, but without a trace of gold."

BATTERY RETURNS.

From Mines on the Highland Mary Line of Reef, and those near Bennion's Reef, at Croydon.

(From the Commencement of the Field up to the end of the Year 1905.)

Details of Battery Returns.

Year.	Name of Mine.	Stone Crushed.		Yield.			Average Value per oz. (approximate).	Total Value (approximate).
		Tons	cwt.	Oz.	dwt.	gr.		
	Sovereign and Post Hole Reefs.							
1887	Sovereign P.C.	58	0	214	17	0		
,,	,, No. 1	74	0	675	0	0		
,,	Post Hole	84	10	783	16	0		
1888	Sovereign No. 1 East	26	0	9	0	0		
1891	,, United	5	2	7	12	0		
,,	Sovereign and Post Hole Extd.	9	0	15	13	0		
,,	,, ,,	5	0	3	18	0		
,,	Post Hole	12	0	6	0	0		
1892	Sovereign and Post Hole Extd.	138	0	195	18	0		
,,	Post Hole	4	10	3	1	0		
1893	Sovereign and Post Hole Extd.	259	0	223	9	0		
1894	,, ,,	120	0	163	19	0		
1897	Sovereign and Post Hole ...	10	0	8	7	0		
1898	,, ,,	5	0	4	4	0		
1899	,, ,,	5	0	7	15	0		
,,	Post Hole	54	0	51	6	0		
	Total	869	2	2,373	15	0	£2/9/-	£5,816
	Sir Walter Reef.							
1887	Sir Walter P.C.	100	0	673	5	0		
1888	,, ,, ...	80	0	479	0	0		
1889	,, ,, ...	74	10	277	0	0		
1890	,, ,, ...	641	0	1,761	6	0		
1891	,, Tribute	20	0	23	13	0		
,,	,, and Lady Mary ...	91	14	294	7	0		
,,	,, and Lady Mary ...	20	0	21	17	0		
1892	,, P.C.	45	5	41	2	12		
1893	,, ,, ...	106	14	144	8	0		
1894	,, ,, ...	92	10	91	18	0		
1895	,, ,, ...	72	5	67	0	0		
1896	,, ...	51	0	59	11	0		
1897	,, ...	12	0	5	3	0		
,,	,, 1 South	10	0	15	0	0		
1898	,, ...	13	15	25	4	0		
1900	,, ...	7	0	11	0	0		
1901	,, (surface)	6	0	10	18	0		
1902	,, ...	10	10	15	10	0		
	Total	1,454	3	4,017	2	12	£2/12/6	£10,545
	Just-in-Time Reef.							
1887	Just-in-time P.C.	104	0	225	0	0		
,,	,, 1 East	68	0	112	14	0		
,,	,, 2 East	100	0	100	0	0		
,,	,, 1 West	62	0	61	17	0		
1888	,, ,, ...	4	5	3	10	10		
1889	,, P.C.	65	0	70	0	0		
,,	,, 2 East	31	17	31	0	0		
1890	,, ,, ...	36	0	42	4	0		
1891	,, ,, ...	2	10	14	10	0		
,,	,, P.C.	22	10	23	7	0		
1892	,, ,, ...	26	14	19	15	0		
1893	,, ,, ...	3	0	1	10	0		
1898	,, ...	15	10	23	6	12		
1899	,, ...	110	5	167	6	18		
1903	,, Tribute	193	0	119	5	0		
	Total	844	11	1,015	5	16	£2/16/6	£2,868

BATTERY RETURNS—*continued.*

Year.	Name of Mine.	Stone Crushed.		Yield.			Average Value per oz. (approximate).	Total Value (approximate).
		Tons	cwt.	Oz.	dwt.	gr.		
	Lady Mary Reef.							
1887	Lady Mary P.C.	243	0	1,359	1	0		
,,	,, No. 1	201	0	1,180	0	0		
,,	,, No. 1 North	96	0	400	18	0		
,,	,, No. 1 South	25	0	27	19	0		
1888	,, P.C.	560	10	1,925	14	0		
,,	,, No. 1	184	0	343	0	0		
1889	,, P.C.	965	0	1,954	8	0		
,,	,, No. 1 North	51	0	101	0	0		
,,	,, No. 1 South	51	18	67	17	0		
1890	,, P.C.	957	0	1,558	19	0		
,,	,, No. 1 North	65	0	82	7	0		
1891	,, P.C.	1,112	10	1,371	2	0		
1892	,, ,,	1,619	0	2,924	7	0		
1893	,, ,,	757	2	1,196	11	6		
,,	,, No. 1 North	12	2	7	17	0		
1894	,, P.C.	329	0	504	12	6		
1895	,, ,,	251	13	206	13	6		
1896	,, ,,	88	15	305	10	0		
,,	,, (surface)	10	0	2	16	8		
1897	,, P.C.	67	5	114	14	0		
,,	,, No. 2	9	0	20	0	0		
,,	,, (surface)	95	0	45	16	0		
1898	Lady Mary P.C.	342	10	222	9	18		
1899	,, ,,	12	0	12	4	0		
,,	,, (surface)	3	0	1	12	0		
1900	,,	8	0	8	13	0		
1901	,,	7	10	5	15	0		
,,	,, (surface)	23	0	28	0	0		
1902	,,	59	0	96	15	0		
1903	,,	107	10	197	15	0		
1904	,,	20	0	21	19	0		
1905	,,	11	10	18	14	0		
	Total ...	8,344	15	16,313	18	20	£2/11/-	£41,600
	Bradlaugh Mine.							
1888	Bradlaugh P.C.	49	15	84	16	0		
1889	,, ,,	19	0	12	17	0		
1890	,, ,,	95	0	85	15	6		
1891	,, ,,	14	0	24	1	12		
1892 to 1905	,, ,,	...		...				
	Total ...	177	15	207	9	18	£2/16/6	£586
	Caledonia Mines.							
1886	Caledonia No. 1 East	136	0	630	9	12		
1887	,, P.C.	154	0	1,073	0	0		
,,	,, No. 1 East	136	0	630	0	0		
1888	,, P.C.	562	10	2,926	0	0		
,,	,, No. 1 East	340	0	1,571	0	0		
1889	,, P.C.	576	0	832	0	0		
,,	,, No. 1 East	238	10	694	10	0		
,,	,, Nos. 1 and 2 East	312	0	992	10	0		
1890	,, P.C.	190	0	335	4	0		
,,	,, Nos. 1 and 2 East	463	0	1,055	2	0		
1891	,, ,,	158	0	547	17	0		
,,	,, P.C.	7	0	17	5	0		
1892	,, ,,	261	0	333	5	0		
1893	,, ,,	674	0	378	1	0		
1894	,, ,,	335	5	506	16	18		
1895	,, ,,	462	10	728	13	12		
1896	,, ,,	178	0	181	8	8		
,,	,, (surface)	40	10	45	16	4		
,,	,, East	12	0	6	15	0		

BATTERY RETURNS—*continued.*

Year.	Name of Mine.	Stone Crushed.	Yield.	Average Value per oz. (approximate).	Total Value (approximate).
		Tons cwt.	Oz. dwt. gr.		
	CALEDONIA MINES—*continued.*				
1897	Caledonia P.C.	5 10	13 0 0		
,,	,, (surface)	34 0	11 7 0		
1898	,, ...	177 0	120 10 0		
1899	,, ...	454 0	734 18 0		
1900	,, ...	40 0	33 10 0		
,,	,, P.C.	30 0	48 10 12		
1901	,, ...	338 0	264 10 0		
		T. C. Q.			
1902	,, ...	16 6 2	15 15 0		
1903	,, ...	161 10 0	138 12 0		
1904	,, ...	19 0 0	18 0 0		
1905	,, ...	9 0 0	10 10 0		
	Total	6,520 11 2	14,894 15 18	£2/16/6	£42,078
	HIGHLAND MARY MINES.				
1887	Highland Mary P.C.	483 0	728 0 0		
,,	,, No. 1 North	69 0	105 10 0		
,,	,, No. 1 South	153 0	328 0 0		
,,	,, No. 2 South	211 0	831 5 0		
,,	,, No. 3 South	94 0	98 17 0		
1888	,, P.C.	1,043 0	2,010 6 0		
,,	,, No. 1 North	70 0	127 1 0		
,,	,, No, 1 South	343 0	760 17 12		
,,	,, No. 2 South	417 0	1,442 6 10		
,,	,, No. 3B South	50 0	67 18 0		
1889	,, P.C.	1,808 10	4,482 0 0		
,,	,, No. 1 North	81 0	26 2 0		
,,	,, No. 1 South	1,118 0	3,074 14 0		
,,	,, No. 2 South	1,499 0	3,068 14 0		
,,	,, No. 3B South	225 0	420 4 0		
1890	,, P.C.	1,007 0	1,889 1 0		
,,	,, No. 1 South	1,891 10	3,829 17 0		
,,	,, No. 2 South	2,057 5	2,063 7 6		
,,	,, No. 3B South	413 10	732 5 0		
,,	,, No. 2 South	51 0	57 0 0		
,,	,, No. 3 West ...	34 0	27 2 0		
1891	,, No. 2 South	235 10	296 6 0		
,,	,, No. 3B South	441 0	956 4 12		
,,	,, No. 1 South	473 0	817 1 0		
,,	,, No. 1 North	427 0	547 18 0		
,,	,, P.C.	1,470 5	2,686 1 18		
,,	,, No. 3 Block	385 0	1,074 9 0		
1892	,, P.C.	2,031 0	5,054 18 8		
,,	,, No. 3B South	712 0	1,875 8 6		
,,	,, No. 1 South	295 0	483 0 0		
,,	,, No. 2 South	626 0	981 6 6		
,,	,, No. 1 North	241 19	178 8 0		
1893	,, P.C.	2,027 13	3,196 6 18		
,,	,, No. 1 South	126 0	151 1 0		
,,	,, No. 2 South	225 0	245 12 0		
,,	,, No. 3B South	623 10	1,453 5 0		
,,	,, No. 1... ...	15 0	22 10 0		
,,	,, No. 1 North	17 0	15 0 0		
1894	,, P.C.	682 10	914 18 12		
,,	,, No. 2 South	27 0	16 12 0		
,,	,, No. 3B South	386 0	645 0 21		
1895	,, P.C.	417 10	340 2 20		
,,	,, No. 1 South	10 0	17 10 0		
,,	,, No. 2 South	54 0	69 7 0		
,,	,, No. 3B South	151 0	168 0 12		
1896	,, United ...	432 0	861 8 0		

BATTERY RETURNS—*continued.*

Year.	Name of Mine.	Stone Crushed. Tons cwt.	Yield. Oz. dwt. gr.	Average Value per oz. (approximate).	Total Value (approximate).
	HIGHLAND MARY MINES—*continued.*				
1896	Highland Mary P.C.* ...	22 0	14 17 15		
,,	,, No. 1 South	33 0	6 4 12		
,,	,, No. 1 North	21 0	10 8 0		
,,	,, No. 3B South	104 0	100 8 12		
,,	,, (surface) ...	257 10	232 3 4		
1897	,, United† ...	1,088 0	2,458 10 0		
,,	,, No. 2 South	34 0	22 10 0		
,,	,, No. 3B South	600 0	640 7 12		
,,	,, (surface) ...	1,531 15	247 4 0		
1898	,, ...	234 0	207 1 0		
,,	,, United† ...	256 0	263 16 0		
,,	,, No. 3B South	247 10	223 18 12		
1899	,, United† ...	153 10	44 16 12		
,,	,, (surface) ..	206 10	109 15 18		
,,	,, No. 3B South	88 0	91 7 0		
1900	,, (general) ...	44 0	74 6 0		
,,	,, (surface) ...	36 10	48 13 0		
1901	,, (surface) ...	6 0	9 0 0		
,,	,, No. 3B ...	72 0	36 4 0		
1902	,, (general) ...	25 0	21 16 0		
,,	,, No. 3B ...	43 0	47 0 0		
1903	,, (general) ...	71 10	67 7 0		
1904	,, ,, ...	77 0	65 0 0		
1905	,, ...	48 10	44 8 0		
	Total	30,950 17	54,325 4 18	£2/8/-	£130,380
	GLENGARRY MINE.				
1887	Glengarry P.C.	156 0	480 0 0		
1888	,, ...	397 0	934 12 0		
1889	,, ...	875 0	2,044 0 0		
1890	,, ...	1,000 0	3,152 16 12		
1891	,, ...	2,921 10	11,010 12 17		
1892	,, ...	655 10	1,737 16 15		
1893	,, ...	401 5	526 11 12		
1894	,, ...	130 10	124 3 20		
1895	,, ...	59 0	73 14 0		
1896	,, (surface)	27 0	21 3 0		
1897	,, ...	38 0	25 5 0		
,,	,, (surface)	68 0	31 16 0		
1898	,, ...	28 10	14 0 0		
1899	,, ...	44 0	16 19 0		
1900	,, ...	27 0	20 0 0		
1903	,, ...	18 0	15 0 0		
1904	,, ...	7 0	7 0 0		
1905	,, ...	6 0	7 8 0		
	Total	6,859 5	20,242 18 4	£2	£40,486
	SIR GARNET MINES.				
1887	Sir Garnet P.C.	410 0	1,192 18 0		
1888	,, ,, ...	150 0	628 13 0		
,,	,, 3 and 4 United ...	376 0	592 8 22		
1889	,, P.C.	721 0	1,848 2 0		
,,	,, Nos. 1 and 2 ...	28 0	36 17 0		
,,	,, Nos. 3 and 4 ...	68 0	199 11 0		
,,	,, Nos. 3 and 4 South	42 0	44 18 0		
,,	,, No. 1 West ...	22 10	19 10 0		
,,	,, United	10 0	4 0 0		

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* Worked as the United after this date. † See also Highland Mary P.C. returns prior to this date.

BATTERY RETURNS—*continued.*

Year.	Name of Mine.	Stone Crushed.		Yield.			Average Value per oz. (approximate).	Total Value (approximate).
		Tons	cwt.	Oz.	dwt.	gr.		
	Sir Garnet Mines—*continued.*							
1890	Sir Garnet P.C.	499	0	1,972	3	6		
,,	,, 1 and 2 United ...	48	10	54	7	3		
,,	,, 3 and 4 United ...	72	0	220	17	18		
,,	,, West	14	0	10	0	0		
1891	,, P.C.	196	4	673	9	0		
,,	,, 1 and 2 United ...	182	0	202	12	0		
,,	,, United	110	0	264	13	0		
,,	,, Consolidated ...	160	0	105	3	0		
1892	,, P.C.	181	0	345	16	0		
,,	,, United	47	0	164	6	8		
1893	,, P.C.	61	0	83	13	22		
,,	,, United	20	0	15	12	0		
,,	,, Nos. 3 and 4 ...	17	6	10	5	0		
1894	,, P.C.	53	10	74	11	6		
,,	,, Limited	10	10	9	1	0		
1895	,, P.C.	6	0	12	5	0		
,,	,, United	26	6	30	6	12		
1896	,, ...	32	0	15	7	0		
1897	,, ...	97	0	35	0	0		
,,	,, (surface)	35	0	20	0	0		
1898	,, Extended	43	0	26	15	0		
1899	,, P.C.	10	0	9	3	0		
,,	,, (surface)	78	0	13	19	0		
	Total	3,821	16	8,936	4	1	£2/12/-	£23,234
	Archer Mines.							
1887	Archer P.C.	18	0	39	5	0		
1888	,, ,, ...	259	15	398	8	12		
,,	,, United	21	0	104	1	7		
,,	,, No. 2 West	26	0	13	7	12		
1889	,, Syndicate United ...	194	0	635	1	0		
,,	,, Block	23	0	18	18	0		
,,	,, No. 1	25	0	21	0	0		
,,	,, No. 1 West	17	0	45	2	0		
,,	,, No. 1 West Block ...	62	10	47	5	0		
,,	,, Limited	61	17	66	11	0		
1890	,, Syndicate	148	0	191	12	12		
,,	,, P.C.	228	0	625	16	8		
,,	,, No. 1	68	0	67	19	0		
,,	,, Block	20	0	51	0	0		
1891	,, P.C.	322	10	463	9	2		
,,	,, No. 1 East	28	0	15	0	0		
,,	,, Nos. 1 and 2	25	0	10	15	0		
1892	,, P.C.	125	8	195	3	0		
,,	,, No. 1	15	0	18	17	0		
1893	,, P.C.	69	12	47	1	0		
,,	,, No. 1	7	10	5	15	12		
1894	,, P.C.	32	1	22	1	0		
,,	,, (Loya)	15	0	10	16	8		
,,	,, (McLean)	27	0	9	7	12		
1895	,, P.C.	38	10	84	17	0		
,,	,, (Gay and party) ...	25	0	21	4	0		
1896	,, ...	148	0	185	1	0		
,,	,, No. 1	25	0	15	10	0		
1897	,, ...	24	10	10	7	0		
1898	,, ...	17	0	14	15	18		
1899	,, (surface)	4	0	2	1	14		
	Total	2,121	3	3,457	8	21	£2/12/-	£8,969

Summary of Battery Returns.

Name of Mine.	Stone Crushed.	Yield.	Average Value per oz.. (approximate).	Total Value (approximate).
MINES NEAR BENNISON'S REEF.	Tons cwt. qr.	Oz. dwt. gr.	£ s. d.	£ s. d.
Sovereign and Post Hole Reef	869 2 0	2,373 15 0	2 9 0	5,816 0 0
Sir Walter Reef	1,454 3 0	4,017 2 12	2 12 6	10,545 0 0
Just-in-Time Reef	844 11 0	1,015 5 16	2 16 6	2,868 0 0
Lady Mary Reef	8,344 15 0	16,313 18 20	2 11 0	41,600 0 0
Bradlaugh P.C.	177 15 0	207 9 18	2 16 6	586 0 0
MINES ON THE HIGHLAND MARY REEF.				
Caledonia Mines—				
Caledonia P.C.	3,435 15 0	7,373 4 2	2 16 6	20,829 0 0
,, East, No. 1 East, and No. 2 East	1,795 10 0	6,128 3 12	2 16 6	17,312 0 0
,, (surface)	74 10 0	57 3 4	2 16 6	162 0 0
,, (locality not stated)	1,214 16 2	1,336 5 0	2 16 6	3,775 0 0
Highland Mary Mines—				
Highland Mary P.C.* ...	10,992 8 0	21,316 12 19	2 8 0	51,159 17 0
,, No. 1 North	926 19 0	1,010 7 0	2 8 0	2,424 16 0
,, No. 1 South	4,442 10 0	9,468 5 0	2 8 0	22,723 15 0
,, No. 2 South	5,436 15 0	9,094 5 22	2 8 0	21,826 4 0
,, No. 3B South†	4,250 10 0	7,556 8 15	2 8 0	18,135 7 0
,, United‡ ...	1,929 10 0	3,628 10 12	2 8 0	8,708 8 0
,, (surface) ...	2,038 5 0	646 15 22	2 8 0	1,552 4 0
,, No. 3 West	34 0 0	27 2 0	2 8 0	65 0 0
,, No. 3 Block	385 0 0	1,074 9 0	2 8 0	2,578 14 0
,, No. 1 ...	15 0 0	22 10 0	2 8 0	54 0 0
,, (locality not given) ...	500 0 0	479 18 0	2 8 0	1,151 15 0
Glengarry P.C.	6,859 5 0	20,242 18 4	2 0 0	40,486 0 0
Sir Garnet Mines—				
Sir Garnet P.C.	2,287 14 0	6,840 14 10	2 12 0	17,785 16 0
,, (other than the P.C.) ...	1,534 2 0	2,095 9 15	2 12 0	5,448 4 0
Archer Mines—				
Archer P.C.	1,093 16 0	1,876 0 22	2 12 0	4,877 10 0
,, (other than the P.C.)	1,027 7 0	1,581 7 23	2 12 0	4,111 10 0
Totals	61,963 18 2	125,784 3 8	2 8 9	306,582 0 0

* Worked as the United after 1895—*see* Annual Report, Department of Mines, 1896.

† Includes No. 3 South returns for 1887, and No. 3B returns for 1901 and 1902.

‡ *See* also Highland Mary P.C. Returns.

By Authority: GEORGE ARTHUR VAUGHAN, Government Printer, William street, Brisbane.

PLATE 1.

GENERAL PLAN OF THE HIGHLAND MARY AND OTHER REEFS AT CROYDON.

The position of the Highland Mary, Caledonia, Lady Mary, Sovereign, Sir Walter, Just-in-Time, Post Hole, Iguana, Bennion's, and other reefs are indicated on the map; also the portion of the long line of reef parallel with the Iguana-Highland Mary line, and known by the names Waratah, Black Snake, The Queen, &c.

PLATE 2.

PLAN OF THE HIGHLAND MARY LINE OF REEF.

Showing old and new leases, bores, and existing and proposed shafts.

REFERENCE.

A. Position of proposed shaft, 1,800 feet from the outcrop of the reef.
B. The No. 1 South Block Shaft which it was proposed to work.
C. Borehole No. 1. *See* Plate 4 for record.
D. Borehole No. 2. *See* Plate 3 for record.
E. Borehole No. 3. *See* Plate 5 for record.
F. The Highland Mary Extended Block Shaft where work is now in progress.
For section on line A-B, *see* Plate 3.
For section on line C-D, *see* Plate 4.
For section on line E-F, *see* Plate 5.

Plan of Highland Mary line of Reef

Illustrating Report on some Croydon Gold Mines
by B. Dunstan Acting Govt. Geologist
1907

Scale 475 feet to an Inch

Drawn at the Geological Survey Office, Brisbane, Queensland.

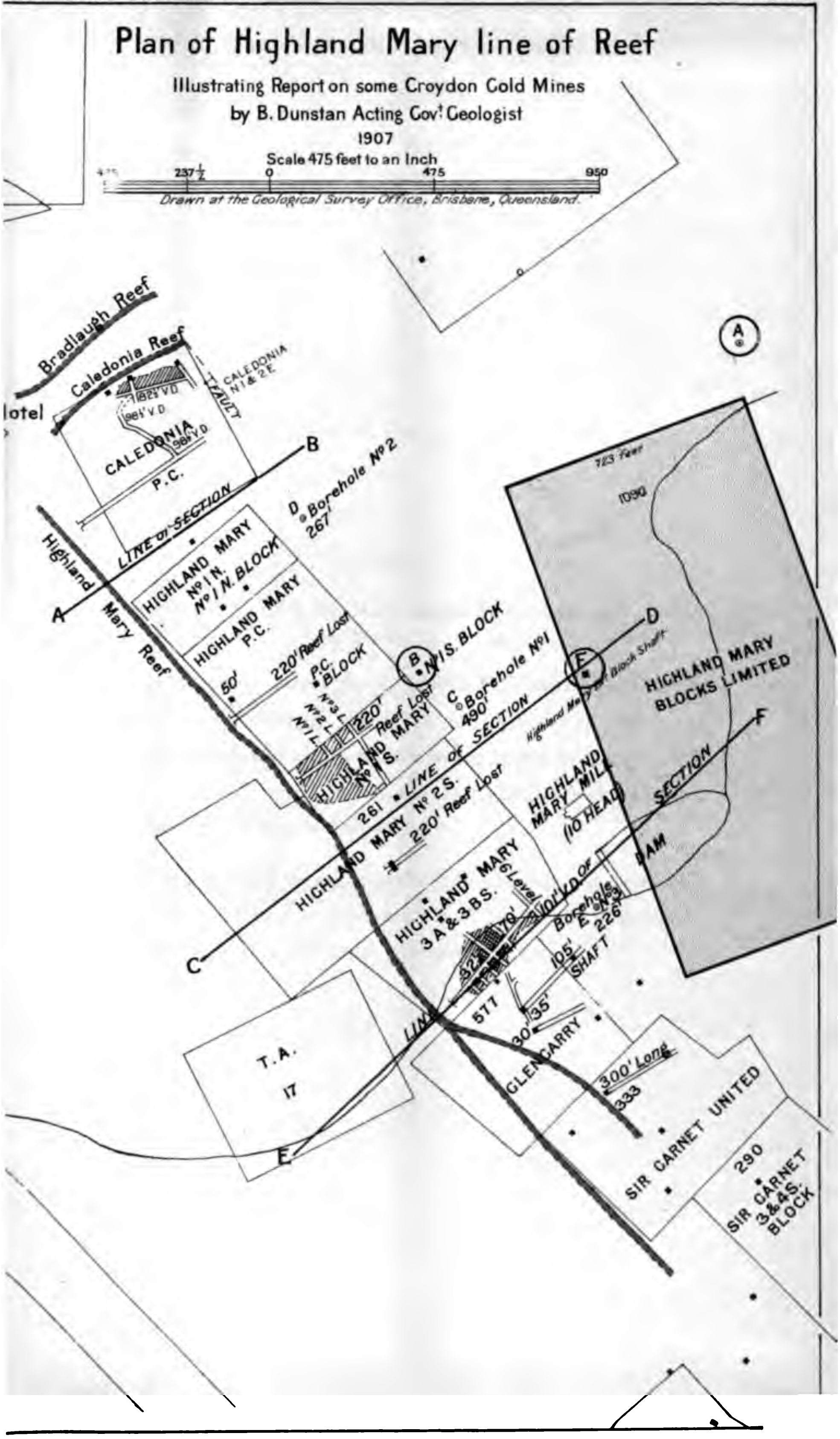

PLATE 3.

SECTION ACROSS THE HIGHLAND MARY REEF, ALONG LINE A-B (SHOWN ON PLATE 2).

This is a section across the Caledonia P.C. workings, showing the position in the underlie where the reef was cut off against a granite head or bar, and also the place where it was found when the underlie was continued through this bar, and where it was again lost further down the workings in the granite.

The record of No. 2 bore-hole is shown on the plate, and indicates the kind of rock which the Caledonia P.C. Underlie would probably have met with if further continued into the deep ground.

Section across the Highland Mary Reef along Line A–B on Plate 2

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1907

Scale 140 feet to an Inch

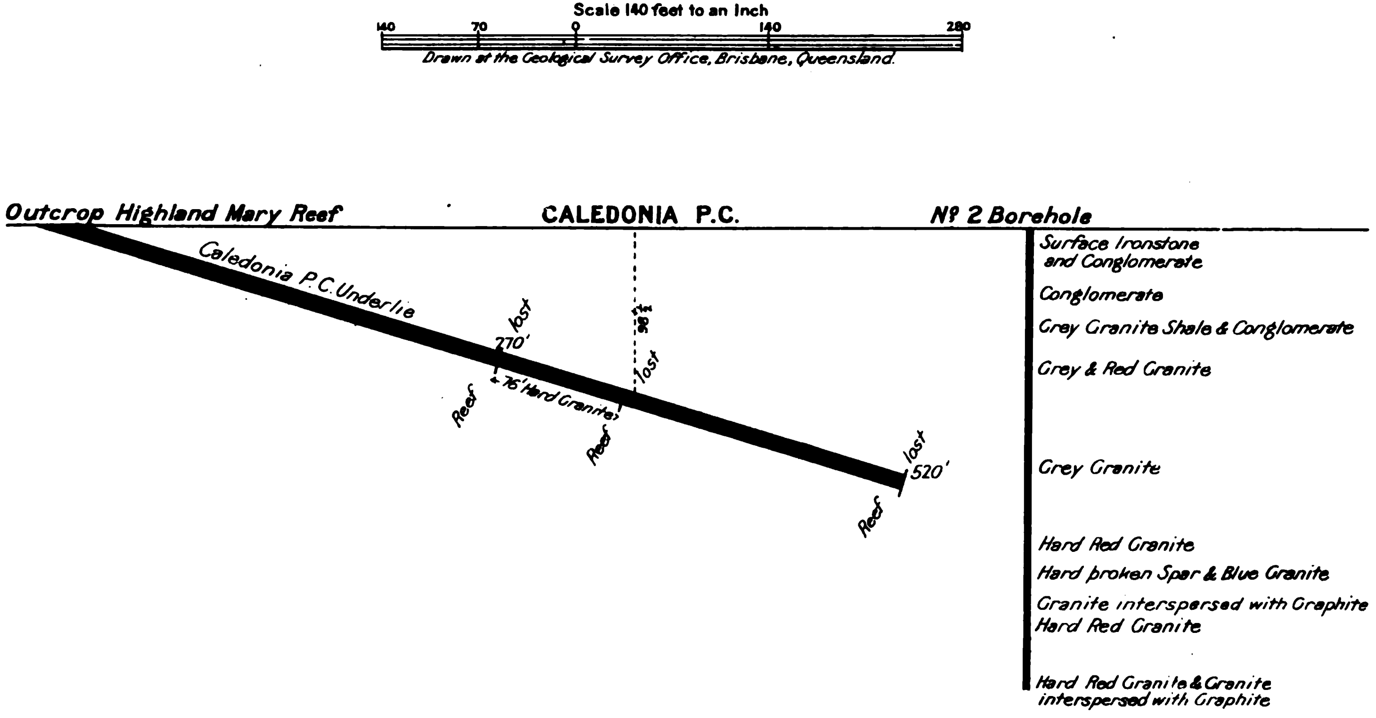
140
70
0
140
280
Drawn at the Geological Survey Office, Brisbane, Queensland.
Outcrop Highland Mary Reef
CALEDONIA P.C.
Nº 2 Borehole
Caledonia P.C. Underlie
lost
270'
96 ft
lost
76' Hard Granite
Reef
Reef
lost
520'
Reef
Surface Ironstone and Conglomerate
Conglomerate
Grey Granite Shale & Conglomerate
Grey & Red Granite
Grey Granite
Hard Red Granite
Hard broken Spar & Blue Granite
Granite interspersed with Graphite
Hard Red Granite
Hard Red Granite & Granite interspersed with Graphite

PLATE 4.

SECTION ACROSS THE HIGHLAND MARY REEF, ALONG THE LINE C-D ON PLATE 2.

The section shows the outcrop of the Highland Mary Reef at the back (west) of the No. 1 South Underlie Shaft, and at the back of the No. 2 South Underlie Shaft. It also shows the position of No. 1 bore-hole, and the record of the rocks passed through, together with the position of the Highland Mary Extended Block Shaft, where operations have started with the object of finding the lost reef. When the shaft has been repaired and cleaned out, the course of action will then depend on the information obtained from an examination of the underground workings.

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1907

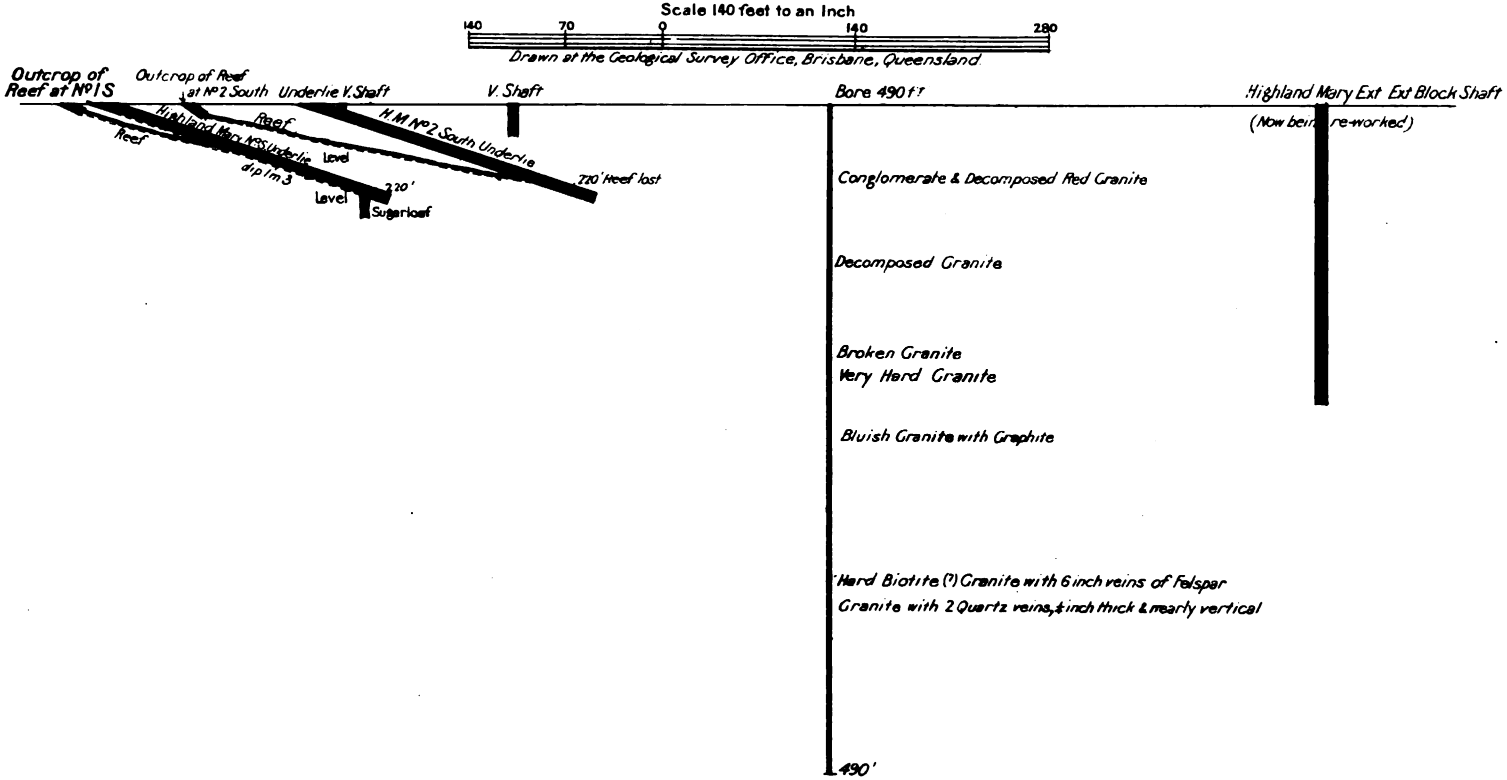
Scale 140 feet to an Inch
140
70
0
140
280
Drawn at the Geological Survey Office, Brisbane, Queensland
Outcrop of Reef at Nº1 S
Outcrop of Reef at Nº2 South
Underlie V. Shaft
V. Shaft
Bore 490 ft
Highland Mary Ext Ext Block Shaft
(Now bein re-worked)
Reef
Highland Mary Nº3 S Underlie
Reef
H.M Nº2 South Underlie
Level
dip 1 in 3
220'
Level
Sugarloaf
220' Reef lost
Conglomerate & Decomposed Red Granite
Decomposed Granite
Broken Granite
Very Hard Granite
Bluish Granite with Graphite
Hard Biotite (?) Granite with 6 inch veins of Felspar
Granite with 2 Quartz veins, ½ inch thick & nearly vertical
490'

PLATE 5.

SECTION ACROSS THE HIGHLAND MARY REEF, ALONG THE LINE E-F ON PLATE 2.

The section is in a line with No. 3 bore-hole, and is taken across the workings of the Glengarry Mine and the Highland Mary No. 3A and B South Underlie Shafts. There is not much difference to be observed in making a comparison of the records of the three bores, and if the information is reliable it would seem, in view of the uniformity of the bar or break on the west side of the line of bores, that nothing is to be gained in prospecting on that side, and that operations should be confined to the east of the line of bores.

along the Line E–F on Plate 2

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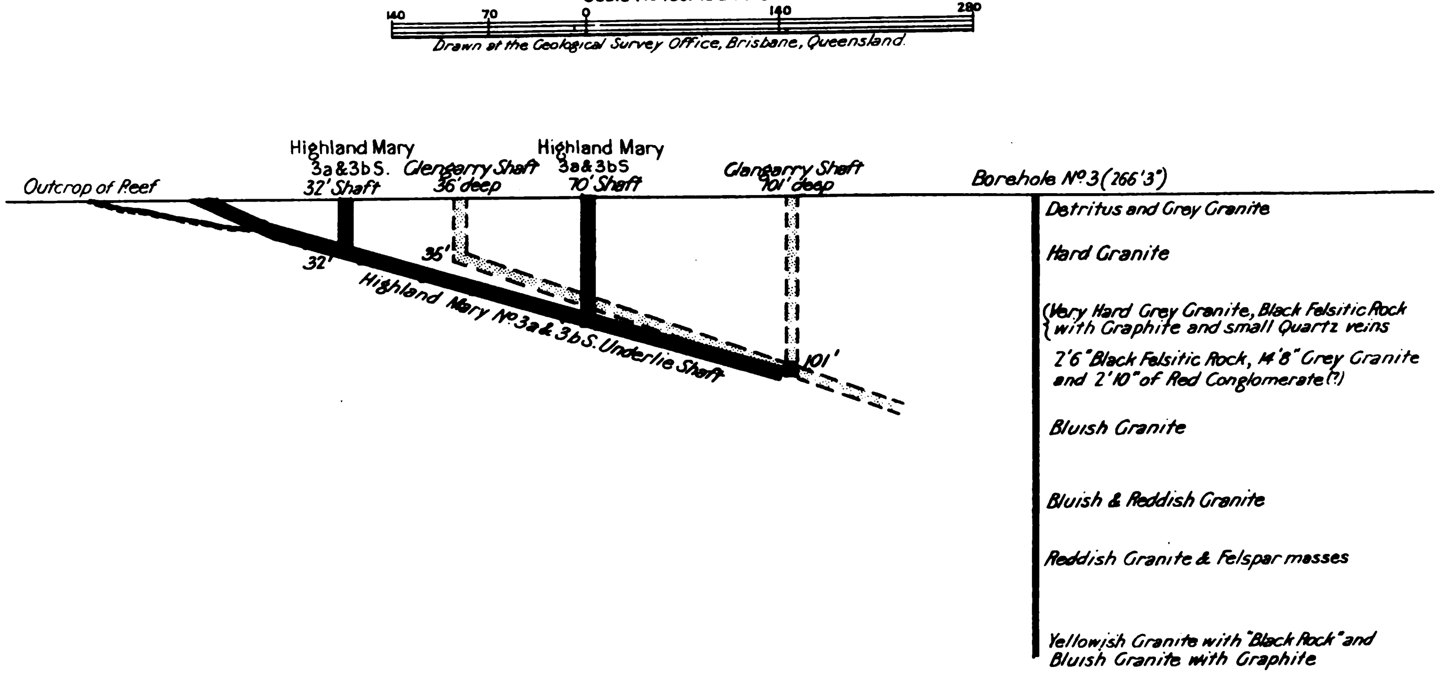
Scale 140 feet to an Inch


140
70
0
140
280
Outcrop of Reef
Highland Mary 3a&3bS. 32' Shaft
Glengarry Shaft 36' deep
Highland Mary 3a&3bS 70' Shaft
Glengarry Shaft 101' deep
Borehole No. 3 (266'3")
32'
35'
101'
Highland Mary No. 3a & 3bS. Underlie Shaft
Detritus and Grey Granite
Hard Granite
Very Hard Grey Granite, Black Felsitic Rock with Graphite and small Quartz veins
2'6" Black Felsitic Rock, 14'8" Grey Granite and 2'10" of Red Conglomerate (?)
Bluish Granite
Bluish & Reddish Granite
Reddish Granite & Felspar masses
Yellowish Granite with "Black Rock" and Bluish Granite with Graphite

Drawn at the Geological Survey Office, Brisbane, Queensland.

PLATE 6.

PLAN OF THE REEFS IN THE TOWN OF CROYDON.

On the plan the general features of the reefs in the vicinity of Bennion's Mine and towards Iguana Hill are shown, and also the trend and position of the Iguana, Chance, Golden Butterfly, Sovereign, Post Hole, Just-in-Time, Sir Walter, and Lady Mary Reefs.

Many of the leases are abandoned, but the names are retained for purposes of identification.

PLATE 7.

DETAIL PLAN OF REEFS IN THE VICINITY OF BENNION'S MINE.

This plan shows the position of Bennion's Reef, the adjoining reefs, and the old workings in the vicinity. The geological features indicate that considerable faulting in the granite has taken place, and that while some reefs, as the result, have been disturbed, there is a great probability of other reefs having come into existence after the disturbance took place. The confusion resulting from the disturbance causes some trouble in following the behaviour of the reefs, and also a difficulty in understanding the results of observations made by individual miners.

The details of this plan are referred to in several portions of the text.

Detailed Plan of the Reef in the vicinity of Bennion's Reef

Illustrating Report on some Croydon Gold Mines

by B. Dunstan Acting Govt Geologist

1907

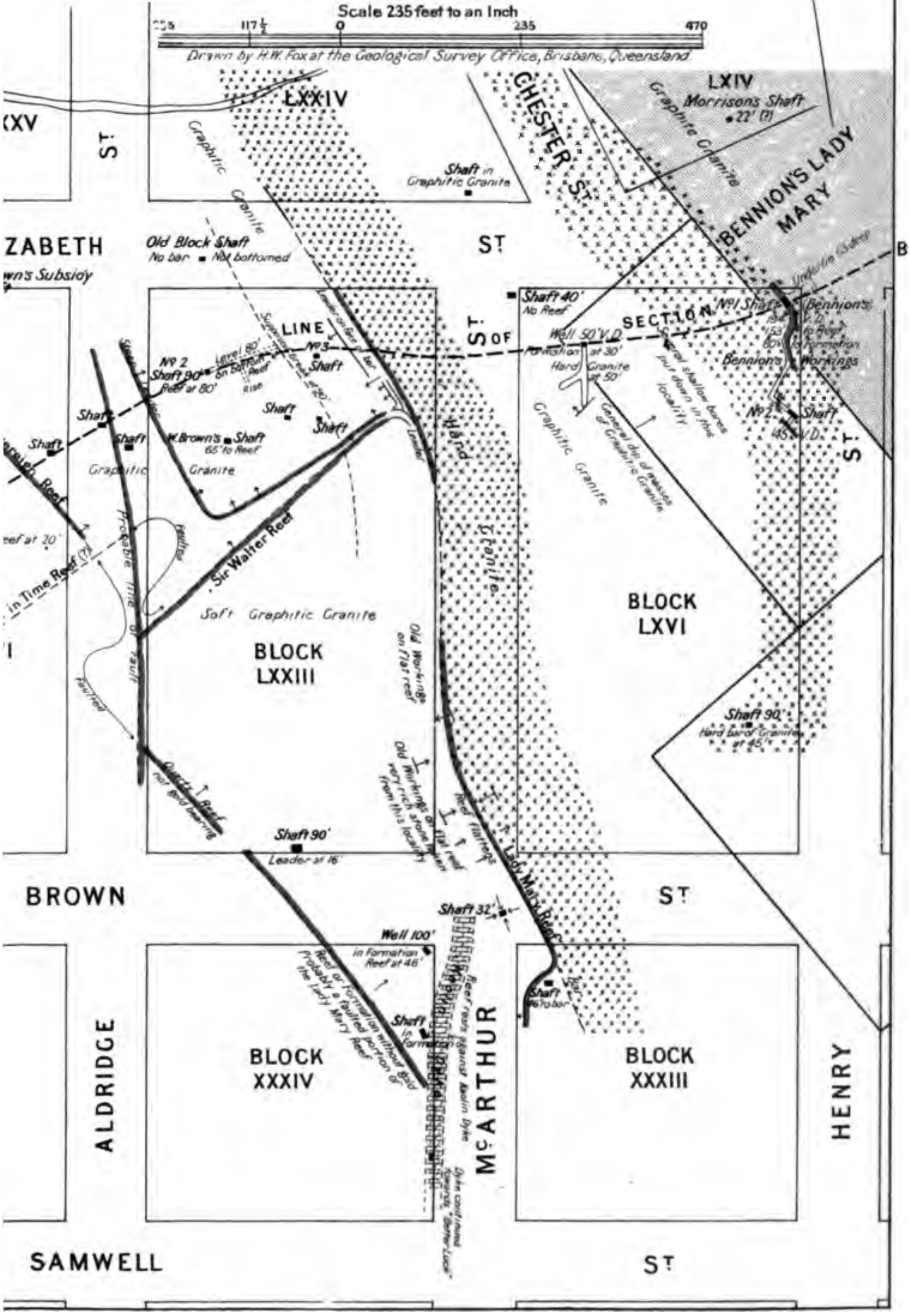


PLATE 8.

PLAN OF THE WORKINGS ON BENNION'S REEF.

The dotted line along the level represents the trend or strike of the (No. 1) reef, the dip being a general eastern one at an angle of about 1 in 3 from the horizontal. The south-eastern extension probably will be found to the north-east of No. 2 Shaft—if the reef does not pinch out.

The reef (No. 2) found in the short crosscut to the south-west of No. 2 Shaft will probably trend in a direction parallel with No. 1 Reef, and some possibility exists of it making larger as it is followed to the south-east.

Plan of Workings on Bennion's Reef

Illustrating Report on some Croydon Gold Mines
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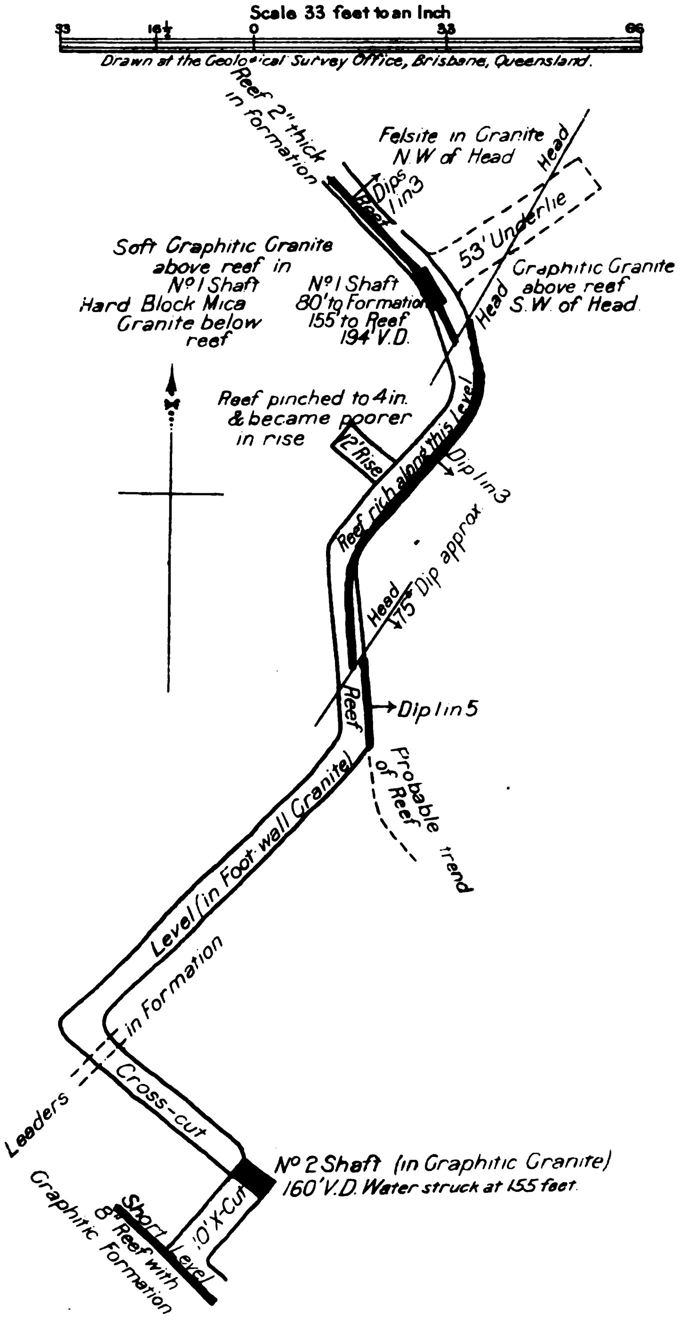
1907


Scale 33 feet to an Inch
33
16½
0
33
66
Reef 2" thick in Formation
Felsite in Granite N.W. of Head
Head
Dips 1 in 3
Reef
53' Underlie
Graphitic Granite above reef S.W. of Head
Head
Soft Graphitic Granite above reef in No. 1 Shaft
Hard Block Mica Granite below reef
No. 1 Shaft 80' to Formation 155 to Reef 194' V.D.
Reef pinched to 4 in. & became poorer in rise
12' Rise
Reef rich along this level
Dip 1 in 3
Dip approx. 75
Head
Reef
Dip 1 in 5
Probable trend of Reef
Level (in Foot-wall Granite)
in Formation
Cross-cut
Leaders
No. 2 Shaft (in Graphitic Granite) 160' V.D. Water struck at 155 feet
10' X-Cut
Short Level
8" Reef with Graphitic Formation

Drawn at the Geological Survey Office, Brisbane, Queensland.

Plan of Workings on Bennion's Reef

Illustrating Report on some Croydon Gold Mines

by B. Dunstan Acting Govt. Geologist

1907

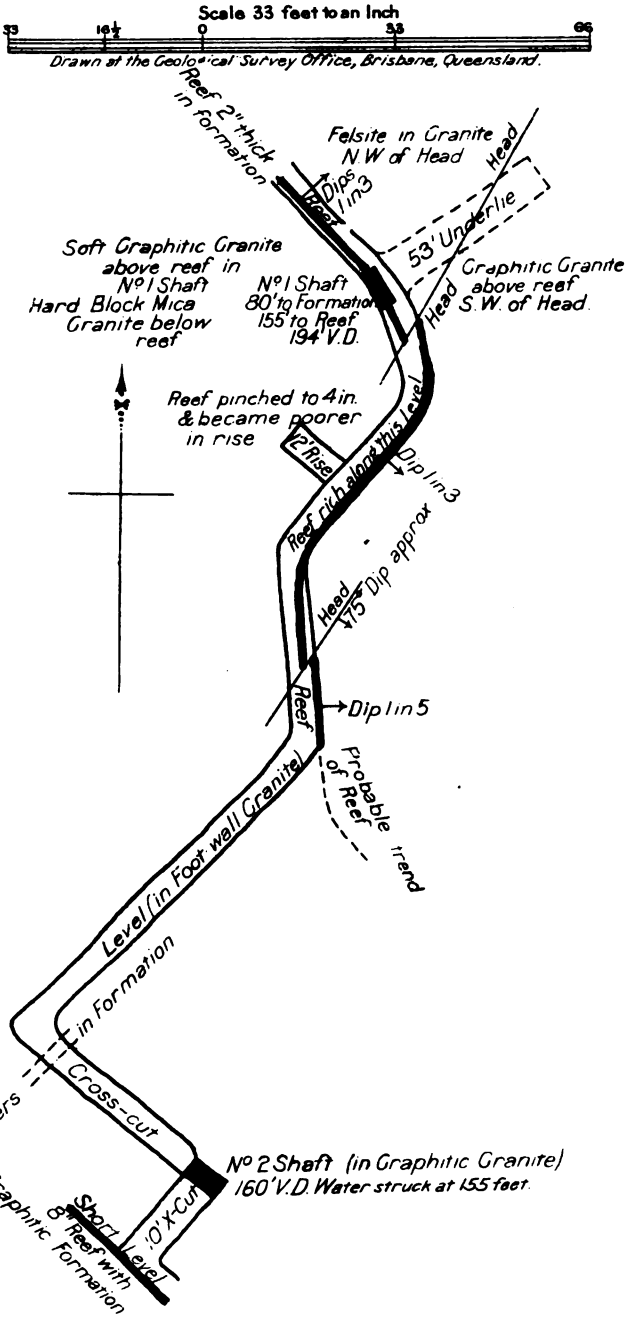

Scale 33 feet to an Inch
33
16½
0
33
66
Drawn at the Geological Survey Office, Brisbane, Queensland.
Reef 2" thick in formation
Felsite in Granite N.W of Head
Head
Dips 1 in 3
Reef
53' Underlie
Soft Graphitic Granite above reef in Nº 1 Shaft
Hard Block Mica Granite below reef
Nº 1 Shaft 80' to Formation 155 to Reef 194 V.D.
Graphitic Granite above reef S.W. of Head
Head
Reef pinched to 4 in. & became poorer in rise
12' Rise
Reef rich along this level
Dip 1 in 3
75 Dip approx
Head
Reef
Dip 1 in 5
Probable trend of Reef
Level (in Foot wall Granite)
in Formation
Cross-cut
Leaders
Nº 2 Shaft (in Graphitic Granite) 160' V.D. Water struck at 155 feet.
10' X-Cut
Short Level
8" Reef with Graphitic Formation

PLATE 9.

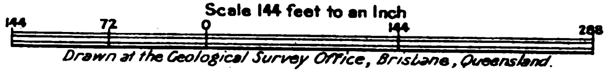
DIAGRAMMATIC SECTION AT BENNION'S MINE.

Showing the position of the Sir Walter and Sovereign workings, the break and leader which the Sir Walter Reef met with, and the graphitic formation passed through in both Bennion's Well and No. 1 Shaft.

& Bennion's Reef. Length of Section 1000 Feet

Illustrating Report on some Croydon Gold Mines
by B. Dunstan Acting Gov.t Geologist
1907

Scale 144 feet to an Inch



Drawn at the Geological Survey Office, Brisbane, Queensland.

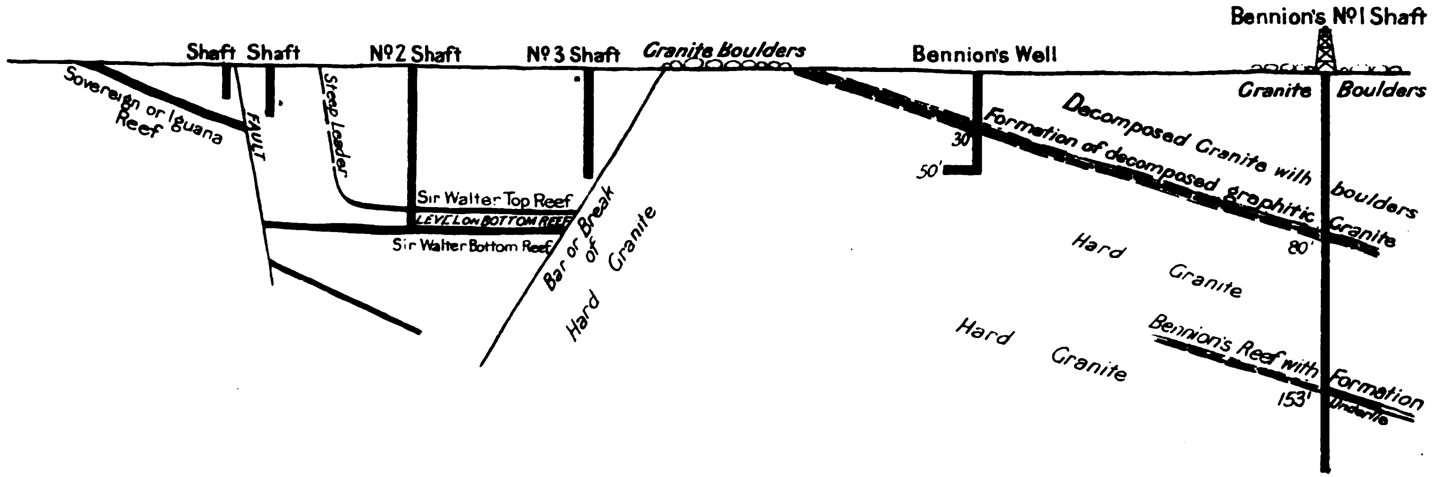


PLATE 10.

BENNION'S MINE, CROYDON.

The photo. is taken from a position north-west of the main (No. 1) shaft. The underlie is dipping towards the front of the picture, the level making an irregular course to the No. 2 shaft in the distance.

Queensland.

DEPARTMENT OF MINES.

GEOLOGICAL SURVEY OF QUEENSLAND.

(B. DUNSTAN, ACTING GOVERNMENT GEOLOGIST.)

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